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Behaviour of Grizzly Bears (Ursus Arctos) in Relation to Closure of The McLeod Lake Landfill, North-central BC Year 1 Progress Report (2000)

M. D. Wood and P. E. Hengeveld
December 2001

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1.0 INTRODUCTION

Existing garbage landfills in smaller communities throughout BC are being phased out over the next few years and either fenced off or replaced by more efficient and inexpensive transfer station systems. This change is also being undertaken in an effort to remove unnatural attractants to bears (*Ursus* sp.), thereby reducing problems that stem from bears conditioned to feeding on human garbage. Improved garbage management is encouraged by the BC Conservation Foundations' Bear Aware program which aims to prevent and reduce conflict between people and bears in BC's communities through education and better attractant management (www.bearaware.bc.ca/).

To date, bears using landfills that have been scheduled for fencing or complete closure have usually been translocated or destroyed (Ministry of Environment, Lands and Parks, 1996). Translocations of problem bears have met with little success overall as food-conditioned bears often become problematic in the new area or travel long distances to return to their original food sources (Miller and Ballard 1982, Brannon 1987, Kansas et al. 1989, MacKay 1996, Ciarniello 1997). In addition, competition with established resident bears in the new area can result in death of the translocated bear. The PWFWCP is investigating an alternative option to direct removal of bears in an effort to conserve at least some landfill-using bears during this period of landfill closure throughout the province. Our option would involve destroying only those bears with a high likelihood of becoming a human safety concern after a landfill closure, while allowing the remaining bears to live without being translocated. We are exploring this option by monitoring grizzly bear (*U. arctos*) response to the scheduled closure of the McLeod Lake landfill in north-central BC in 2001. This closure provides an opportunity to learn about and classify bear behaviour around landfills, and to relate their pre-closure behaviour to their fates after landfill closure. The primary objectives of the McLeod Lake Grizzly Bear Behaviour Study are:

1. To classify the behaviour of individual grizzly bears that use the McLeod Lake landfill into those that become a threat to humans after landfill closure and those that do not (i.e. certain ages/sexes of bears, or bears with a high degree of dependence on the landfill, may be more likely to become problematic after closure), and thereby
2. To improve decisions made by the Conservation Officer Service during subsequent landfill closures regarding which individual bears should be destroyed and which should not (i.e., we aim to identify the characteristics of bears, if any, that are more likely to seek out alternate garbage resources after a landfill closure, and those that are not).

The project is being conducted over a 3-year period: 2000 (pre-landfill closure), 2001 and 2002 (post-landfill closure). The landfill servicing the community of McLeod Lake was replaced by a transfer station in January 2001. To assist us in meeting our objectives, we are examining several characteristics of each individual bear including age, sex, reproductive status, frequency of landfill use prior to closure, home range size, and movement patterns. This progress report documents the results of capture and monitoring of grizzly bears during pre-landfill closure Year 1 (2000).

2.0 STUDY AREA

The study area is centered on the McLeod Lake landfill approximately 110 km north of Prince George in north-central BC (Figure 1). The study area is located within the Prince George and Mackenzie Forest Districts, and lies primarily within the Fraser Basin ecoregion and the Nechako Lowland and McGregor Plateau ecosections (Demarchi 1995).

The topography of the study area is primarily characterized by a gently rolling plateau landscape, with elevations ranging between 800 and 1,200 m. The extreme eastern portion of the study area lies within the mountainous Hart Ranges of the Rocky Mountains (approximately 25 km east of McLeod Lake). Biogeoclimatic subzones on the plateau include the moist cool Sub-Boreal Spruce (SBSmk1) subzone west of McLeod Lake, and the wet cool SBSwk1 subzone to the east (DeLong et al. 1993, DeLong et al. 1996). Higher elevations on the plateau (1,100-1,200 m) lie within the moist, very cold Engelmann Spruce-Subalpine Fir subzone (ESSFmv3; McKinnon et al. 1990) while higher elevations between 1,200 and 1,500 m in the Hart Ranges lie within the wet cool (ESSFwk2) and wet cold (ESSFwc3) subzones (DeLong et al. 1994). Alpine Tundra (AT) exists above 1,500 m (DeLong et al. 1994). Tree species dominating the plateau landscape include hybrid white spruce (*Picea glauca x engelmannii*), lodgepole pine (*Pinus contorta*), and subalpine fir (*Abies lasiocarpa*). The plateau has a typical sub-boreal climate, with long snowy winters, and moist cool summers (DeLong et al. 1993).

The McLeod Lake landfill (800 m elevation) is located 450 m east of McLeod Lake and 350 m east of Hwy 97, a major 2-lane paved highway that extends northward from Prince George past McLeod Lake into the Pine Pass (Rocky Mountains; Figure 1). The small community of McLeod Lake (pop. ~125), 4 km north of the landfill, was serviced by the landfill until it was replaced by a transfer station in January 2001. The landfill site was backfilled and covered over with soil in the summer of 2001.

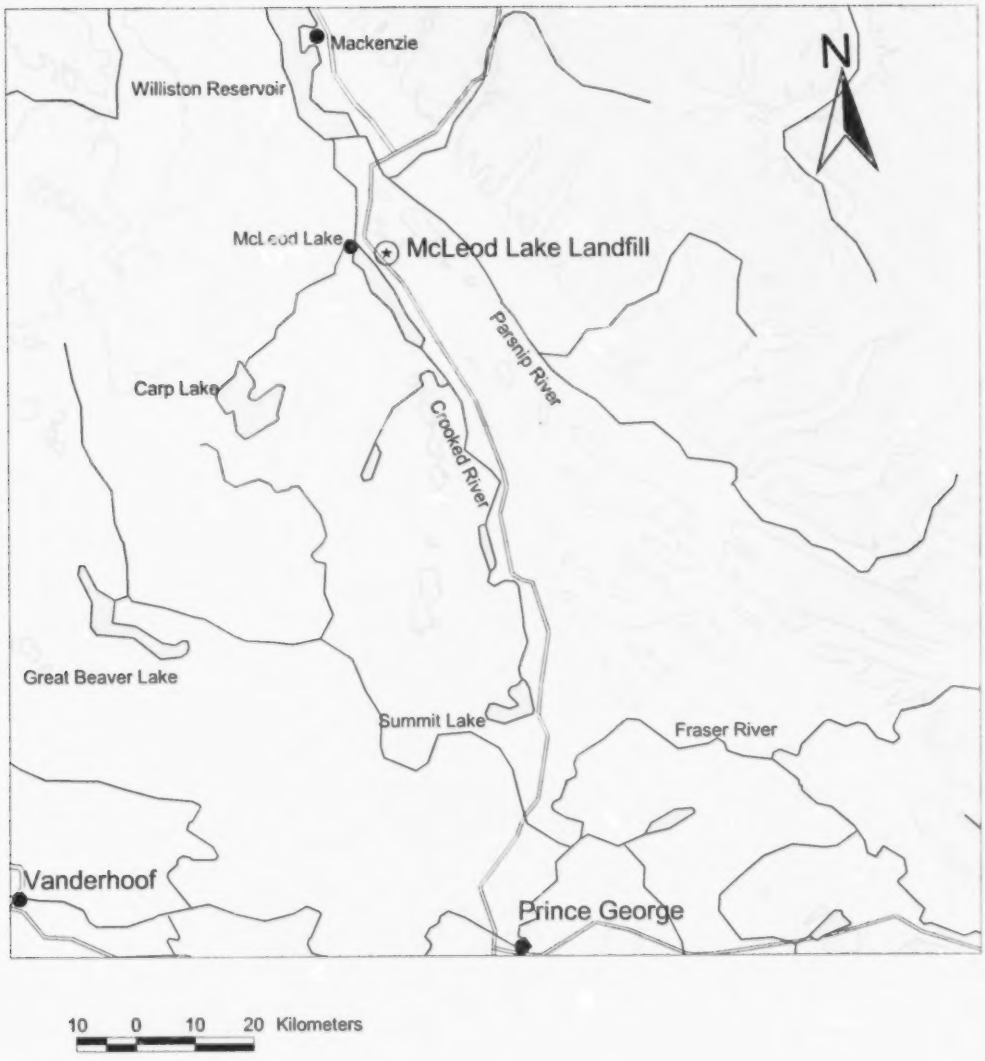

Figure 1. Location of the study area for the McLeod Lake Grizzly Bear Behaviour Project in north-central BC.

3.0 METHODS

3.1 Capture

We trapped grizzly bears for 26 nights between 25 April - 30 May, and 30 nights between 29 August – 5 October, 2000. We captured grizzly bears in 135-cm diameter metal culvert traps, and in cubby sets and trail sets using Aldrich snare sets (Margo Supplies, Calgary, AB) with 65-mm anchor and throw cables. To avoid catching young cubs, multiple layers of electrician's tape were placed near the end of the throw cable to prevent the cable from cinching too tight. Culvert traps and cubby sets were baited with beaver (*Castor canadensis*) in spring, and moose (*Alces alces*) in fall; coarse fish were also tried as bait in fall. We set traps and snares within the landfill itself, and on the natural gas pipeline right-of-way 500 m east of the landfill. Snare sets within the landfill were cabled to large logs specifically cut and hauled into place. A trap-night is defined as one trap set for one night.

Traps were set between 1800 and 0600 hr in spring and 1800 to 0700 hr in fall, during which time the landfill was closed to the public. Signage was placed at the landfill road entrance advising the public of closures due to trapping. A pick-up truck was also used to block the road entrance during closure periods to prevent public access. We remained in the landfill every evening to observe grizzly bears using the landfill, and to deal with any bears captured before dark. After dark, we observed bears using night vision equipment (3rd generation Scout Eagle monocular, Westinghouse, Toronto, Ontario).

3.2 Immobilization and Tagging

We immobilized captured grizzly bears using Telazol® (tiletamine hydrochloride and zolazepam hydrochloride) at an attempted dosage of 8 mg/kg; body weight was visually estimated prior to immobilization. We darted bears in snare sets using a Palmer Cap-Chur CO_2 pistol from the cab of a pick-up truck. A handheld jabstick was used to deliver Telazol® to bears captured in culvert traps and to administer secondary dosages to partially sedated animals in snare sets. Ketaset® (ketamine hydrochloride) at a dosage of 2 mg/kg, or Telazol® at varying dosages, were used as top-up drugs when necessary, and were either hand-injected intramuscularly or delivered by jabstick. We processed most bears at their capture sites in the landfill, although some bears were transported 500 m to the gas pipeline for processing to ensure human safety (e.g., other bears in the landfill, or public required access to the landfill). As a precautionary measure, we attached a

secured snare cable to one foot of the bear for the immobilization period; for snared bears, the cable was removed from the snared foot and attached to an alternate foot. All bears were blindfolded, and vital signs (pulse, body temperature, and respiration) were monitored regularly throughout the immobilization period.

We collected approximately 10 ml of blood from the femoral vein of each captured grizzly bear in 6-ml clotting blood tubes (red-top) and 6-ml EDTA blood tubes (purple-top) (Vacutainer®, Becton Dickinson, Franklin Lakes, New Jersey). Blood in red-top tubes was allowed to clot at room temperature for 10-15 hours; serum was then siphoned off with a pipette, placed into 3-ml red-top serum storage tubes, and frozen and archived for future analyses. Whole blood (purple-top) was frozen and archived for genetic analyses. A tissue sample was obtained from the ear using a biopsy punch, then stored frozen in a paper envelope and shipped to Wildlife Genetics International, Edmonton, Alberta, for genetic analysis. Fourteen loci were examined to determine genotypes of each individual bear, and identify parent-offspring relationships. We extracted an upper first premolar (PM1) during immobilization using a dental elevator and extractor. Cementum aging of teeth was conducted by Matson's Laboratory, Milltown, Montana. Hair samples with roots were collected in paper envelopes and archived for future genetic analysis; feces were also collected if available, and then frozen. We administered 3.0 – 20.0 ml of a long-acting broadspectrum antibiotic (Bio-mycin 200®, Boehringer Ingelheim Canada Ltd., Burlington, Ontario) subcutaneously to most bears.

We took standard body measurements, and weighed all bears using a tripod built from wooden poled with two 200 kg Detecto dial scales (Butchers and Packers, Edmonton, AB) hanging beneath a block and tackle. A more effective chain hoist was used in the fall. We estimated body condition in the fall as Poor, Fair, Good, or Excellent as follows (LeCount 1986 in: Jonkel 1992):

Poor: Hip bones, shoulder blades, backbone and ribs easily felt. Bear appears to be a skeleton with skin stretched over it; looks unhealthy.

Fair: Hip bones, shoulder blades, backbone and ribs can be felt but are not prominent. Bear appears thin but not unhealthy.

Good: Hip bones, shoulder blades, backbone, and ribs are difficult to feel. Bear appears healthy but not extremely fat.

Excellent: No bones can be felt. Bear appears extremely fat and healthy.

All adult and larger subadult grizzly bears were fitted with LMRT-4 radio-collars with internal antennas and mortality option (Lotek Engineering, Newmarket, Ontario). Two to 4 layers of

industrial-strength cotton fire hose were inserted between brackets joining the two ends of the collar's belting together, thus allowing for the collar to drop off after the fire hose deteriorated. Juvenile bears (cubs-of-the-year {COY} to 3 years of age), adult males, and some adult females were fitted with 22-g ear-tag transmitters with mortality option (Advanced Telemetry Systems, Isanti, Minnesota). Ear-tag transmitters used in the spring were programmed to transmit only during the daytime (0900 and 1700 hr) on weekdays (Monday – Friday) in order to save on battery life, whereas all ear-tag transmitters placed on bears in the fall transmitted continuously. Both transmitter types were programmed to turn off during winter. A third group of ear-tag transmitters were programmed to delay their operation until April 2001; these transmitters were attached in combination with another ear-tag transmitter or radio-collar. Each bear was also fitted with colour coded and numbered ear-tags for identification purposes; where ear-tag transmitters were used, the backings were colour-coded.

3.3 Landfill Use

An SRX_400 datalogging radio-telemetry receiver (Lotek Engineering Inc., Newmarket, ON) was used to monitor bear use of the McLeod Lake landfill between 30 May and 29 November 2000. The datalogger unit and enclosure was erected 250 m east of the landfill, and was powered by a 12V battery supported by 2 solar panels. The datalogger utilized Lotek's W21 Event_Log software, an automatic signal detection and analysis software package. The receiver was programmed to scan all radio frequencies of tagged bears on a 10-minute interval. When a signal was detected, the program temporarily suspended its scanning, and measured the signal strength on each of 3 directional antennas. One antenna pointed directly west towards the landfill; the other two were aimed away from the landfill (SSE and NNE). Bear radio-tag frequencies were programmed into the datalogger within one day of capture. Test transmitter frequencies were also programmed into the datalogger, and transmitters were positioned at various locations around the landfill to identify the configuration of signal strengths received on the antennas. This enabled us to better interpret data collected on tagged grizzly bears, including identifying when bears were within the general landfill area. Data were downloaded from the SRX_400 into a Toshiba Pentium laptop computer at least every 3 weeks, and converted into MS Excel format for analysis.

The number of nights each bear was recorded in the landfill was summarized and presented as frequency per calendar month. Four bears captured in spring were fitted with daytime-weekday ear-tag transmitters. If any of these transmitter frequencies were recorded by the datalogger in

the vicinity of the landfill during the day, we assumed that the bear had visited the landfill that night. We therefore used the number of days the bear was recorded in the vicinity of the landfill as an indication of landfill use for these bears. However, we consider this to represent the minimum number of visits to the landfill because bears recorded in the landfill at night that wore continuously transmitting ear-tags were not always recorded in the vicinity of the landfill during the previous or subsequent day.

3.4 Aerial Radio-Telemetry

We conducted radio-telemetry monitoring flights in a Cessna 182 fixed-wing aircraft, using pilots experienced with aerial telemetry and a biologist as an observer. Telemetry equipment included a Telonics TR2 scanning receiver, switchbox, and dual H antennas (Telonics Ltd., Mesa, Arizona) mounted on the wing struts. The monitoring period extended from the time of capture to the time of denning. We initially attempted to conduct flights every 10 days, weather permitting, then increased our attempts to weekly flights after mid-July.

An attempt was made to locate all radio-tagged animals on each flight. We recorded the co-ordinates obtained from an on-board GPS unit, group size, activity (e.g. feeding, travelling), and habitat characteristics for each tagged animal location. Habitat data included dominant tree species, canopy cover, snow cover, slope, and aspect for each location. Location coordinates were manually plotted on topographic and forest cover maps (Ministry of Forests 1990) to discern site elevations and forest cover designations. Elevations were read to the nearest 50 m from contour levels on 1:50,000 scale topographic maps. A Polaroid photograph was taken of each bear location to identify site access for future microsite investigations and den investigations, and along with field notes made in flight, to assist in plotting the location into the correct forest cover polygon.

In some cases family groups contained multiple radio-tagged individuals, thus an individual telemetry location represented more than one radio-tagged bear. Prior to being captured and fitted with radio-tags, incidental sightings of unmarked family members that were observed with radio-tagged family members were also included in our data analyses.

The PGBP also conducted aerial telemetry on some McLeod Lake landfill bears and methods used and data collected were similar; these data were included in our analyses.

3.5 Home Range Use and Movements

We estimated 100% Minimum Convex Polygon (MCP) annual home ranges for radio-collared grizzly bears captured in spring with >18 aerial radio-telemetry locations (including their landfill capture location and den site). MCP home ranges were calculated using RangesV (Kenward and Hodder 1996). Fall home ranges (based on aerial radio-telemetry locations obtained between 1 September and the main movement to their den site, and including one landfill location as determined by the datalogger) were calculated for males and females with >5 locations to provide an indication of the extent of area used during fall. Statistical differences between males and females, and between fall and annual home ranges, were calculated using Mann-Whitney U-tests with a significance level of ≤0.05. Statistical tests were performed using Statistica Version 5.0 (StatSoft, Tulsa, OK).

3.6 Habitat Use

For examination of seasonal habitat use by bears, we identified seasons as spring (den emergence to 30 Jun), summer (1 Jul to 31 Aug), and fall (1 Sep to denning). Locations obtained by aerial telemetry were grouped into 1 of 5 broad habitat types defined by primary tree species:

Coniferous	Stands with ≥ 80% conifer trees.
Mixedwood	Stands with ≥ 20% each of conifer and deciduous trees.
Deciduous	Stands with ≥ 80% deciduous trees.
Cutblock	Previously forested sites that were logged <21 years ago. Includes replanted sites with immature stands <10.5 m tall.
Non-commercial	Non-productive brush, not satisfactorily restocked (NSR) lands, meadows, and riparian shrub.

To avoid duplication of non-independent samples (i.e., family groups travelling together), on occasions when more than one radio-tagged bear from a family unit were located together, the location was used only once in the habitat data analyses. If members of a family unit were located separately (e.g., >100m apart) then each separate location was included. Telemetry locations from all radio-tagged grizzly bears were lumped for examination of seasonal habitat use patterns. Capture and den site locations were excluded from spring and fall habitat use analyses; den site habitat descriptions are discussed separately in the results.

An effort was made to conduct ground site investigations at telemetry locations to assess microsite habitat use by radio-tagged grizzly bears. Our primary objective in conducting site investigations was to determine whether landfill-using bears were feeding or resting when they were not at the landfill and if they were feeding, to determine the types of foods consumed. Only those telemetry locations that were accessible by ground transport (i.e., within reasonable hiking distance from a road) were investigated, including sites where bears dropped their transmitters. Sites were visited within 2 weeks of obtaining the location in order to ensure that fresh sign (that could be attributed to the bear of interest) would be present for interpretation of site use by radio-tagged grizzly bears.

At least 2 people were present during all site investigations. The field crew navigated to the site using forest recreation maps, a handheld GPS unit, the site co-ordinates obtained by telemetry, and the Polaroid photograph of the location. Upon approaching the location, the crew searched for fresh grizzly bear sign (e.g., evidence of feeding, scat, hair, day beds). Plot centre was identified where the highest concentration of fresh sign was observed. Detailed notes were taken regarding the presence of any grizzly bear sign. Site characteristics collected within a 5-m radius of plot centre included vegetation and soil descriptions. As an index of visual cover, horizontal visibility was measured 15 m from plot centre in each cardinal direction using a 2-m pole marked with 50-cm increments. UTM coordinates, slope, aspect, and elevation were recorded at each site. A site diagram was sketched and photographs were also taken.

Although extensive site investigations were intended, administrative and scheduling difficulties hindered this component of the project thus few site visits were completed.

4.0 RESULTS

4.1 Capture and Handling

We captured 13 individual grizzly bears at the McLeod Lake landfill: 6 in spring and 7 in fall, 2000 (Table 1, Appendices A and B). Two bears (M08 and F09) had been previously captured and radio-collared by the PGBP on 25 May 2000 at Firth Lake, 20 km south of the McLeod landfill. [The PGBP refers to these bears as GM36 and GF35 respectively.] No black bears were observed or captured at the landfill. Three wolves were captured in snare sets in the fall (1, 3, and 28 Sep respectively; Appendix B).

Table 1. Sex, age and weights of grizzly bears captured at the McLeod Lake landfill in spring and fall 2000.

ID No.[1]	Sex	Age (yrs)[2]	Weight (kg)	Date of 1st Landfill Capture
F01	F	1	38.0	29-Apr
F02	F	8	175.0	20-Apr
M03	M	2	117.0	9-May
F04	F	2	86.0	9-May
M05	M	17	383.0[3]	23-May
F06	F	1	51.0	27-May
F07	F	3	112.5	31-Aug
M08	M	3	145.0	31-Aug
F09	F	n/a[4]	176.5	1-Sep
F10	F	4	193.0	1-Sep
F11	F	2	117.0	18-Sep
F12	F	5	165.0	27-Sep
M13	M	0 (cub of year)	33.0	1-Oct

[1]F=female, M=male
[2]Age at last birthday (based on 1 Feb)
[3]Too heavy for single scale and weighing poles; weight estimated based on chest girth (Jonkel 1992)
[4]Tooth extracted by PGBP; age unavailable

Capture success at the McLeod Lake landfill was 3 times higher in fall than in spring (Table 2; Appendix A). We captured 6 individual grizzly bears during 9 captures in spring, and 12 different bears in 36 captures in fall (Appendix B). Baited cubby sets in the landfill were most successful in spring, while baited culvert traps were most effective in fall. In spring, snare sets in the landfill were 8x (trail sets) and 12 x (cubby sets) more successful than culvert traps. The opposite was true in fall with baited culverts being 5x more successful than landfill trail sets (Table 2).

Only 2 grizzly bears (F02 and F07) were captured in >1 trail snare-set within a trapping season (Table 2); both were caught twice in the fall, each time in different trail set locations. Locations of trail snare-sets were not moved within a trapping season, and it appeared that bears quickly learned to avoid snare-sets. We observed bears that approached trail snare-sets either retreat and take an alternate route, or paw at and trip the set then continue through. Culvert traps were also established at specific locations within the landfill although avoidance was not observed. Six bears were captured more than once in baited culvert traps, all in the fall: F02 (n=6), F07 (n=4), F04, F06, and F09 (n=3 each), and F11 (n=2) (Table 2). Bears F06 and F09 were never captured in the same culvert twice. Conversely, each of the other 4 bears was captured in the same culvert trap two or more times: F02 was caught in the same culvert trap 5 times over the course of a 23-day period in September 2000. F02 was observed to exhibit less aggressive behaviour with each

successive capture. Aversive conditioning through the use of capsicum pepper spray on F02 was attempted prior to her release during her last 3 culvert captures (21, 26, and 29 Sep). She was not captured again after 29 September, however, we ceased trapping only 5 days later.

Table 2. Number of grizzly bear captures and capture success rates in spring and fall for 4 different trap types used at the McLeod Lake landfill, 2000. **S** = Aldrich snare, trail set; **CBl** = Aldrich snare, baited cubby set in immediate landfill area; **CBg** = Aldrich snare, baited cubby set on gasline 400 m from landfill; **C** = baited culvert trap. (Bait used in cubbys and culverts was beaver in spring and moose in fall.)

	No. of	Spring					Fall			
ID No.	Captures	S	CBl	CBg	C	Total	S	CBg	C	Total
F01	4	1	1		1		1			
F02	9	1					2		6	
M03	1	1								
F04	7	1	1				1	1	3	
M05	2	1							1	
F06	4				1				3	
F07	6						2		4	
M08	2						1		1	
F09	4						1		3	
F10	2						1		1	
F11	2								2	
F12	1						1			
M13	1						1			
Captures	45	5	2	0	2	9	11	1	24	36
Trap-nights	548	46	13	30	149	238	176	56	78	310
Success[1]	8.2	10.9	15.4	0	1.3	3.8	6.3	1.8	30.8	11.6

[1]Success = number of captures per 100 trap-nights

4.1.1 Non-Capture Related Injuries

In August 1999, a sow with 3 COY was illegally shot near McLeod Lake (S. Dowling, Mackenzie Conservation Officer, personal communications). One cub was shot approximately one month later near Tudyah Lake Provincial Park. The two remaining orphans (F01 and F06) denned over the winter, and were first observed at the landfill on 9 April 2000. Based on capture data, both cubs appeared to have suffered wounds resulting from buckshot. F01 was first captured on 30 April and her left hind-leg appeared broken and partially healed at the knee, and 4 buckshot-sized holes were evident. When observed on 9 April, she exhibited difficulty walking and vocalized often. F01 was recaptured again on 5 September. The broken bone had set and her leg was moveable, though still offset at an angle. It was difficult to detect any sign of

limping when she was observed in the landfill. F06 was first captured on 27 May and she exhibited a small buckshot-sized wound near her spine. This wound had not healed by the time she was recaptured on 25 September though her mobility did not appear to be adversely affected.

M05 was captured on 23 May and again on 14 September. The 17-year-old male's canine teeth were broken and well rounded (the top left canine was also fractured during his initial capture), and several incisors were missing. M05's chest girth was 4.5 cm smaller in fall than spring, and he appeared to be in declining health.

4.1.2 Capture Related Injuries

F07 was captured after dark on 31 August in a snare set within the landfill. Since her mother and large male sibling remained in attendance at the snare site, the situation was deemed unsafe for the tranquilizing crew and resulted in the bear being left in the snare overnight. The bear incurred a severe self-inflicted injury to her right ankle, below the holding point of the snare cable. The wound was approximately 15-cm long and 4-cm wide and had severed through bone leaving the foot hanging and only partially attached. In consultation with a wildlife veterinarian, a decision was made to clean the wound and release the injured bear. F07 was captured again on 17 September at which time extensive flesh had been exposed below the original injury site, likely due to licking or chewing by the bear. She was observed moving about the landfill on 3 legs on many subsequent occasions, carrying the injured foot off the ground. The large exposed area of flesh was observed to be healing when captured again on 30 September and 2 October. Between 5 - 18 November, F07 moved to a den site in the mountains 42 km west of the landfill with her mother and sibling.

M13 was captured in the landfill in an overnight snare set on 1 October. This COY was tangled in the snare cable and may have been immobile for a period of time. When measured after immobilization, M13's body temperature was at 96.4°C and he shivered incessantly during handling. We increased his body temperature by placing him in the cab of a heated truck. No injuries were sustained, and the bear was successfully released to reunite with his mother (F12).

In fall 2000, we recaptured 4 grizzly bears fitted with ear-tag transmitters the previous spring. All bears possessed a circular knob of raw tissue under each side of the attached transmitter. Blood and pus were also matted in the hair around the ear-tag. The wounds appeared fresh and there was little evidence of healing. Use of ear-tag transmitters for future grizzly bear radio tagging should be strongly reconsidered.

4.2 Immobilization, Sampling, and Tagging

We recorded drug dosages administered and immobilization sequences (Appendix C), physical characteristics, weights and measurements (Appendices D and E), and biological samples collected and antibiotic treatments administered (Appendix F) for all grizzly bears captured. Five grizzly bears were captured in both spring and fall, thus allowing us to compare seasonal weight gain (Table 3). Two orphaned yearlings (F01 and F06) more than doubled their body weight in a 4-month period, while the mature adult male (M05) appeared to lose weight through the summer (Table 3), likely a result of his age and poor tooth condition. The relationship between chest girth and the actual weight of the animal was found to closely approximate that of the chest girth-weight relationship presented for grizzly bears in Jonkel 1992 (Appendix G).

Table 3. Weight gain by grizzly bears captured at the McLeod Lake landfill in both spring and fall 2000.

ID No.	Age[1]	Spring Capture	Spring Wt (kg)	Fall Capture	Fall Wt (kg)	Weight Gain (%)	Weight Gain (gms/day)	No. of Months
F01	1	29-Apr	38.0	5-Sep	90.5	138%	407	4.3
F02	8	30-Apr	175.0	6-Sep	220.0	26%	349	4.3
F04	2	9-May	86.0	12-Sep	148.0	72%	492	4.0
M05	17	23-May	~383.0[2]	14-Sep	343.2	-10%	n/a	3.8
F06	1	27-May	51.0	25-Sep	112.0	120%	504	4.0

[1]Age at last birthday (based on 1 Feb)
[2]Too heavy for single scale and weighing poles; weight estimated based on chest girth

All bears except M13 (COY) were radio-tagged for subsequent monitoring (Appendix H). Two grizzly bears (F02 and M03) dropped their collars within 4 months of collar attachment due to deterioration of the fire hose. F02 dropped her collar on 6 September between 1300 (when it was last heard actively transmitting during a radio-telemetry flight) and 2045 (when she was recaptured at the landfill without her collar). Three layers of fire hose had been used in her collar attachment. She was fitted with a new collar on 7 September and released. M03 dropped his collar (attached with 2 layers of fire-hose wrapped with duct tape) between 24 - 30 August leaving him with only an ear-tag transmitter programmed for daytime-weekdays. M03 was not recaptured during the fall trapping sessions. Daytime-weekday ear-tag transmitters on the two orphaned yearlings (F01 and F06) were replaced with 24-hour ear-tag transmitters during their fall recaptures. The daytime-weekday ear-tag transmitter on F04 was replaced with a radio-collar in the fall; her delayed program transmitter (scheduled to start in Apr 2001) was also replaced due to a broken antenna.

4.3 Parent-Offspring Relationships

Parent-offspring relationships of the 13 grizzly bears captured at the landfill are presented in Table 4. Based on observational data (trapping and telemetry) 2 adult females were accompanied by cubs during 2000: 5-year-old F12 with 2 COY including M13, and F09 (age unknown) who was still accompanied by two 3-year-old cubs (F07 and F08). Based on genetic analysis, 8-year-old F02 appears to be the mother of three 2-year-old bears captured at the landfill: M03, F04, and F11. All 3 offspring share an allele in common with F02 at every loci analysed which is strong evidence for a parent-offspring relationship. All 3 subadults also denned within 2 km of F02 over the winter of 2000/01. It appears that these offspring were driven off by F02 in the spring of their second year; they were never located in the presence of F02 during any radio-telemetry flights throughout 2000. The fourth adult female, 4-year-old F10, did not have cubs.

Interestingly, genetic analysis concluded that the only prime adult male captured at the landfill (M05) did not father any of the aforementioned cubs. The only captured bear that could be an offspring of M05 is F09. However, genetic analysis of F09 was based on only 6 loci instead of 14 (the sample was obtained through the PGBP), and is therefore not definitive. Subtracting the known mother's genetic contribution generated the potential genotypes of fathers to the 3 sets of cubs. It appears that the 3 sets of cubs were fathered by different unknown males (referred to as UM#1, UM#2, and UM#3; Table 4). It is possible that orphaned yearlings F01 and F06 are also offspring of hypothetical father UM#1 (father of F07 and M08). No tissue sample was collected for F01 but all alleles from F06 match that of UM#1; a definitive relationship can not be confirmed with the genotype of the mother however, as she was shot in 1999 and no samples were collected.

Table 4. Parent-offspring relationships based on observational and genetic data for grizzly bears captured at McLeod Lake landfill, spring and fall 2000.

Mother	Father[1]	Offspring		
F09	UM#1	F07	M08	
F02	UM#2	M03[2]	F04[2]	F11[2]
F12	UM#3	M13	cub#2[3]	
UF#1[4]	UM#1?	F01	F06	

[1]UM = unidentified male inferred from genetic analysis (not captured in study)
[2]Offspring inferred from genetic analysis only (not observed with mother F02)
[3]Second cub observed with mother F12 but not captured during study; sex unknown
[4]UF#1 = mother of cubs F01 and F06, shot in 1999 (not captured in study)

4.4 Landfill Use

In 2000, grizzly bears were first observed using the McLeod Lake landfill on 9 April; no bear sign was evident during a site visit on 5 April. A number of local reports confirmed that the 2 orphaned yearlings (F01 and F06) observed on 9 April used the landfill throughout the rest of the month; we first caught F01 on 29 April. Other grizzly bears were observed at and captured in the landfill throughout late April and May 2000, though use of the landfill (as determined by nightly observation and capture success rate) was deemed to be low. After 30 May, landfill use by radio-tagged grizzly bears was ascertained using the remote datalogger unit stationed 250 m from the landfill (Table 5).

Repeat visits to the landfill were made by all bears except M03 (Tables 5 and 6, Figure 2, and Appendices I - N). Only 4 datalogger fixes were recorded for M03, all on the same day and located toward the west side of McLeod Lake (Table 5). Some use of the landfill by the orphaned yearlings and adult male M05 occurred in June and July; 2 visits were also made by F04 in July. Landfill use by bears increased in mid to late August, reaching a peak in October when many bears used the landfill every night of the month (Table 6, Figure 2, Appendices I – N). Use of the landfill declined in November as bears moved off to den sites. Contrary to the general trend of limited spring and summer use and heavier fall use, adult male M05 made greater use of the landfill in the months of July and August than in fall.

The maximum number of radio-tagged bears recorded in the landfill in one night was 10; this occurred on 27 September and 5 subsequent occasions in October. The 2 missing bears were subadult male M03 (never recorded at the landfill), and adult male M05 whose last recorded visit to the landfill was 15 September.

4.5 Aerial Radio-Telemetry

Twenty-seven aerial telemetry flights were conducted between 16 May and 11 December 2000: 5 flights in spring, 9 in summer, and 13 in fall. The number of locations obtained per bear or family group was largely influenced by their capture and denning dates, thus the number of locations ranged from 6 (F12) to 48 (F09) fixes (Table 7). With the exception of subadult male M03, all bears were consistently located throughout their monitoring period (i.e., from initial capture to denning); M03 roamed widely and was not located during several of the monitoring flights.

Table 5. Number of fixes per bear collected on a 10-minute scan by a remote radio-telemetry datalogger situated at the McLeod Lake landfill between 30 May and 29 November 2000. Fixes include all locations when the bear was within approximately 500-600 m of the landfill.

ID No.	Date of 1st capture[1]	No. of fixes Collected	Date of 1st record at/near landfill	Date of last record at/near landfill
F01	29-Apr	6,710	31-May	15-Nov
F02	30-Apr	3,260	30-Jun	27-Oct
M03	9-May	4	15-Sep	15-Sep
F04	9-May	4,713	4-Jul	11-Nov
M05	23-May	2,284	30-May	17-Sep
F06	27-May	5,114	2-Jun	15-Nov
F07	31-Aug	2,878	5-Sep	5-Nov
M08	25-May	4,139	13-Aug	5-Nov
F09	25-May	4,074	13-Aug	5-Nov
F10	1-Sep	1,872	3-Sep	16-Oct
F11	18-Sep	3,923	19-Sep	14-Nov
F12	27-Sep	1,045	1-Oct	5-Nov

[1]Date of first capture in McLeod Lake landfill for all bears except M08 and F09 where date of first capture by the PGBP was used instead

Table 6. Number of nights per month each radio-tagged grizzly bear visited the McLeod Lake landfill between 1 June and 29 November 2000. Parentheses indicate the number of telemetry nights available in each month for each bear (i.e., the datalogger was working and the bear was "on-line"). Numbers in **boldface** are for bears wearing daytime-weekday ear-tag transmitters and that were located by the datalogger in the vicinity of the landfill during the previous and/or subsequent day.

ID No.	Date of 1st Capture[1]	Jun	Jul	Aug	Sep[2]		Oct	Nov
					D	N		
	29-Apr	**11 (22)**	**7 (21)**	**9 (23)**	**0 (2)**	15 (25)	30 (30)	14 (30)
F02	30-Apr	0 (30)	0 (31)	4 (28)		20 (24)	20 (30)	0 (30)
M03	9-May	**0 (22)**	**0 (21)**	**0 (23)**	**0 (20)**		**0 (21)**	**0 (22)**
F04	9-May	**0 (22)**	**2 (21)**	**4 (22)**	**0 (6)**	15 (18)	29 (29)	9 (30)
M05	23-May	2 (30)	14 (31)	13 (31)		7 (29)	0 (29)	0 (30)
F06	27-May	**8 (22)**	**5 (21)**	**6 (23)**	**5 (16)**	6 (6)	28 (29)	14 (30)
F07	31-Aug			1 (1)		17 (27)	30 (30)	5 (30)
M08	25-May	0 (30)	0 (31)	10 (30)		23 (29)	30 (30)	5 (30)
F09	25-May	0 (30)	0 (31)	9 (30)		22 (28)	30 (30)	5 (30)
F10	1-Sep					19 (28)	14 (30)	0 (30)
F11	18-Sep					9 (12)	30 (30)	14 (30)
F12	27-Sep					1 (4)	11 (30)	2 (30)

[1]Date of first capture in McLeod Lake landfill for all bears except M08 and F09 where date of first capture by the PGBP was used instead

[2]Number of days (D) that bears with daytime-weekday ear-tag transmitters were within the vicinity of the landfill; number of nights (N) that bears used the landfill after replacement of their daytime-weekday ear-tag transmitters with 24-hr ear-tag transmitters or radio-collars.

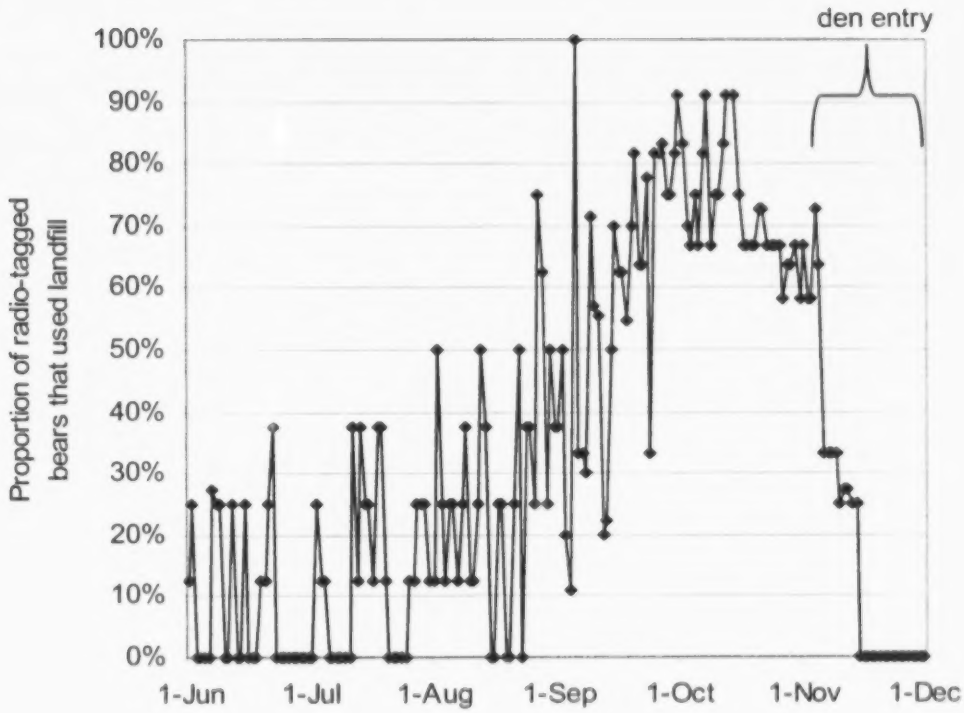

Figure 2. Proportion of radio-tagged grizzly bears that used the McLeod Lake landfill between 1 June and 1 December 2000. Average number of bears on-line per month (range follows in brackets): 6.9 ± 1.8 in Jun (4-8), 6.7 ± 1.9 in Jul (4-8), 6.8 ± 1.8 in Aug (4-8), 9.1 ± 2.5 in Sep (2-12), 11.6 ± 0.6 in Oct (10-12), 11.7 ± 0.5 in Nov (11-12).

Two hundred and twenty-two (222) locations were obtained for the 12 radio-tagged bears, including 74 aerial-telemetry locations collected by the PGBP (Table 7). Two family groups with multiple radio-tagged individuals were monitored throughout 2000: orphaned yearling siblings F01 and F06, and adult female F09 with 3-year-old cubs F07 and M08. Each family group generally travelled as a unit, thus 53 of the 222 telemetry locations represent more than one radio-tagged bear. The orphaned siblings were found together on 18 occasions (including one occasion that was prior to F06 being radio-tagged). F09 was located together with both her cubs on 22 occasions (cub F07 was sighted with F09 and M08 from the aircraft 5 times prior to being radio-tagged, and 17 times after). F09 was located alone with her male cub M08 12 times (10 of these were prior to radio-tagging of her other cub F07); she was located alone with her female cub F07 only once.

Table 7. Number of aerial radio-telemetry locations collected by this study and the PGBP per radio-tagged grizzly bear during monitoring flights in spring (den emergence – 30 Jun), summer (1 Jul – 31 Aug), and fall (1 Sep – denning), 2000. For orphaned siblings F01 and F06, and female F09 and cubs F07 and M08, parentheses indicate the number of shared locations.

ID No.	Initial flight date	Denning date	Number of locations			
			Spring	Summer	Fall	Total
F02	16 May	1 Nov	8	13	18	39
M03	16 May	1 Dec	3	12	3	18
F04	16 May	18 Nov	7	9	8	24
M05	25 May	09 Nov	5	9	9	23
F10	03 Sep	1 Nov			8	8
F11	27 Sep	18 Nov			7	7
F12	04 Oct	18 Nov			6	6
F01	16 May	22 Nov	6 (3)	9 (9)	12 (6)	27 (18)
F06	05 Jun	22 Nov	5 (3)	9 (9)	11 (6)	25 (18)
F07	06 Sep	18 Nov	2 (2)	2 (2)	23 (19)	27 (23)
M08	31 May	18 Nov	7 (6)	15 (8)	23 (21)	45 (34)
F09	31 May	18 Nov	7 (6)	18 (8)	23 (20)	48 (35)

4.6 Home Ranges

4.6.1 Home Range Size

We estimated annual home ranges for the 8 radio-tagged grizzly bears that had >18 aerial radio-telemetry locations (including the landfill capture-location) collected between spring capture (Apr/May) and fall den entry (Nov/Dec) 2000 (Table 8, Figures 3 and 4). The mean annual 100% MCP home range size of female grizzly bears (330.6 km^2 ± 378.8 km^2 SD; n=5) was much smaller than for males (1,860.3 km^2 ± 1,426.3 km^2 SD; n=3) (Mann Whitney U test, p = 0.053). Two orphaned female yearlings that remained close to the landfill throughout the year had the smallest home ranges (30 - 32 km^2), while the largest belonged to the subadult male M03 (3,387 km^2). Fall home ranges were calculated for all bears with >5 aerial radio-telemetry locations for the period between 1 Sep and their main movement toward their den site. Although bears were not located at the landfill during aerial telemetry flights, all bears were located at the landfill at least once by the remote datalogger during the fall period. There was no significant difference between the mean fall home range of females (mean = 23.3 km^2 ± 21.4 km^2 SD, n=9) and males (mean = 145.4 km^2 ± 157.8 km^2 SD, n=2) (Mann-Whitney U-test, p = 0.194) (Table 8). The mean fall home range size of female grizzly bears (mean = 23.3 km^2 ± 21.4 km^2 SD; n=9) was significantly smaller than their mean annual range (mean = 330.7 km^2 ± 378.9 km^2 SD; n=5) (Mann-Whitney U-test, p = 0.053).

Table 8. Female and male annual and fall home range sizes (100% Minimum Convex Polygon) based on aerial-telemetry and the McLeod landfill datalogger for radio-tagged grizzly bears captured at the McLeod Lake landfill, 2000.

		Annual Home Range		Fall Home Range	
ID #	Age	Size (km^2)	N	Size (km^2)	N
F01[1]	1	30	28	4	10
F02	8	288	40	55	17
F04	2	346	25	1	8
F06[1]	1	32	26	5	10
F07[2]	3			36	21
F09	n/a	957	49	51	21
F10	4			34	7
F11	2			2	7
F12	5			23	5
Mean (SD)		330.7 (378.9)	6	23.3 (21.4)	9
M03	2	3,387	19		
M05	17	562	24	257	9
M08[2]	3	1,632	46	34	21
Mean (SD)		1,860.2 (1,426.5)	3	145.4 (157.8)	2

[1]orphaned female yearlings
[2]often accompanied adult female F09

4.6.2 Home Range Use and Movements

F01 / F06: Orphaned yearling females

Orphaned yearlings F01 and F06 remained together throughout most of the year, and were always located in close proximity (<10 km) to the landfill (Figure 3). They were consistently located on the westerly-facing slopes to the north and east of the landfill. F01 and F06 were the only bears that were sighted by residents in the McLeod lake townsite during the spring of 2000. They were never located by aerial telemetry west of Hwy 97. In spring, they frequented areas to the north and northeast of the landfill, visiting the landfill occasionally for periods of 1 - 4 days. They continued frequent visits to the landfill of 1-2 days duration throughout the summer, and used areas primarily east and northeast of the landfill. F01 and F06 used the landfill on a daily basis between the latter part of September and mid-November, when they left the area to locate a den site. Aerial telemetry during this period found them consistently within 2 km of the landfill. The orphans denned together <10 km north of the landfill (Figure 5).

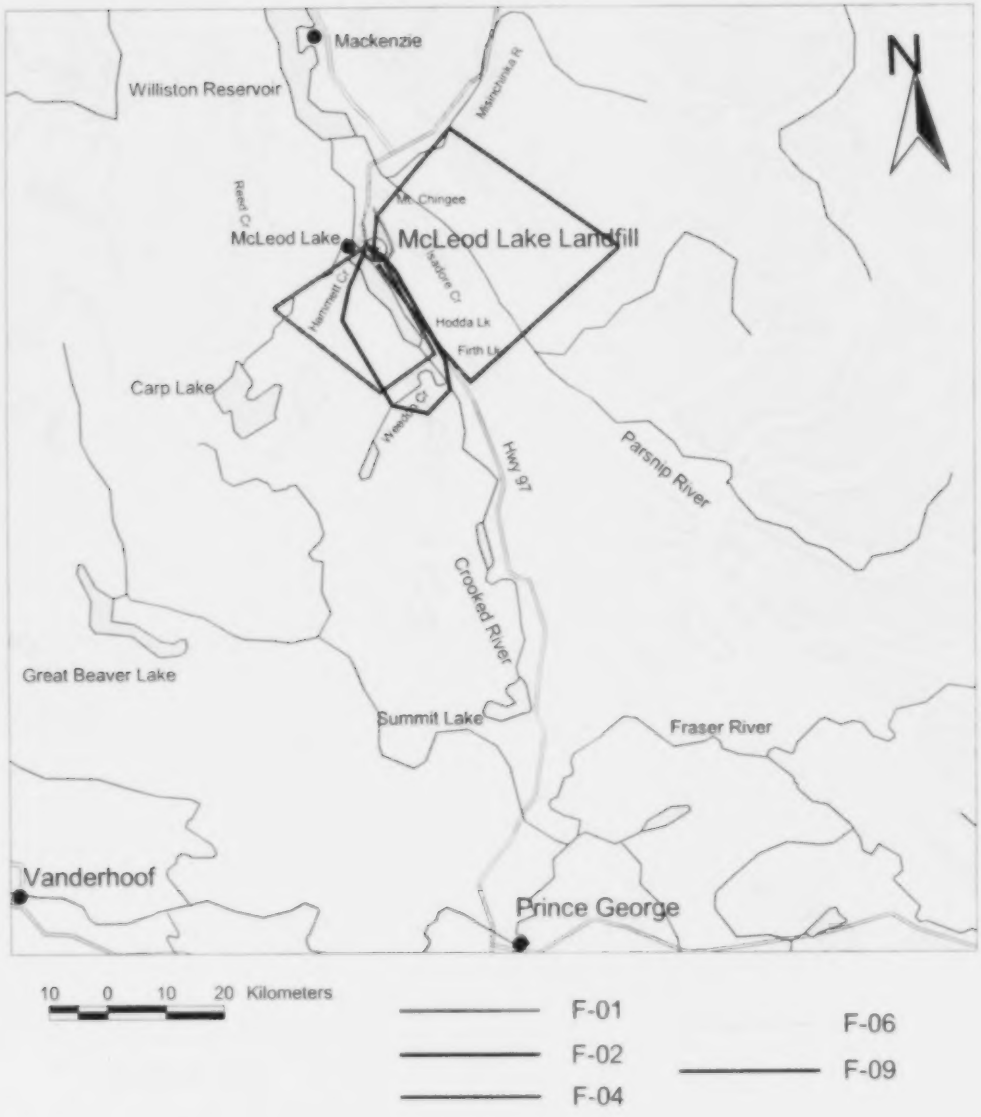

Figure 3. Annual home ranges of radio-tagged female grizzly bears that were captured at the McLeod Lake landfill, 2000.

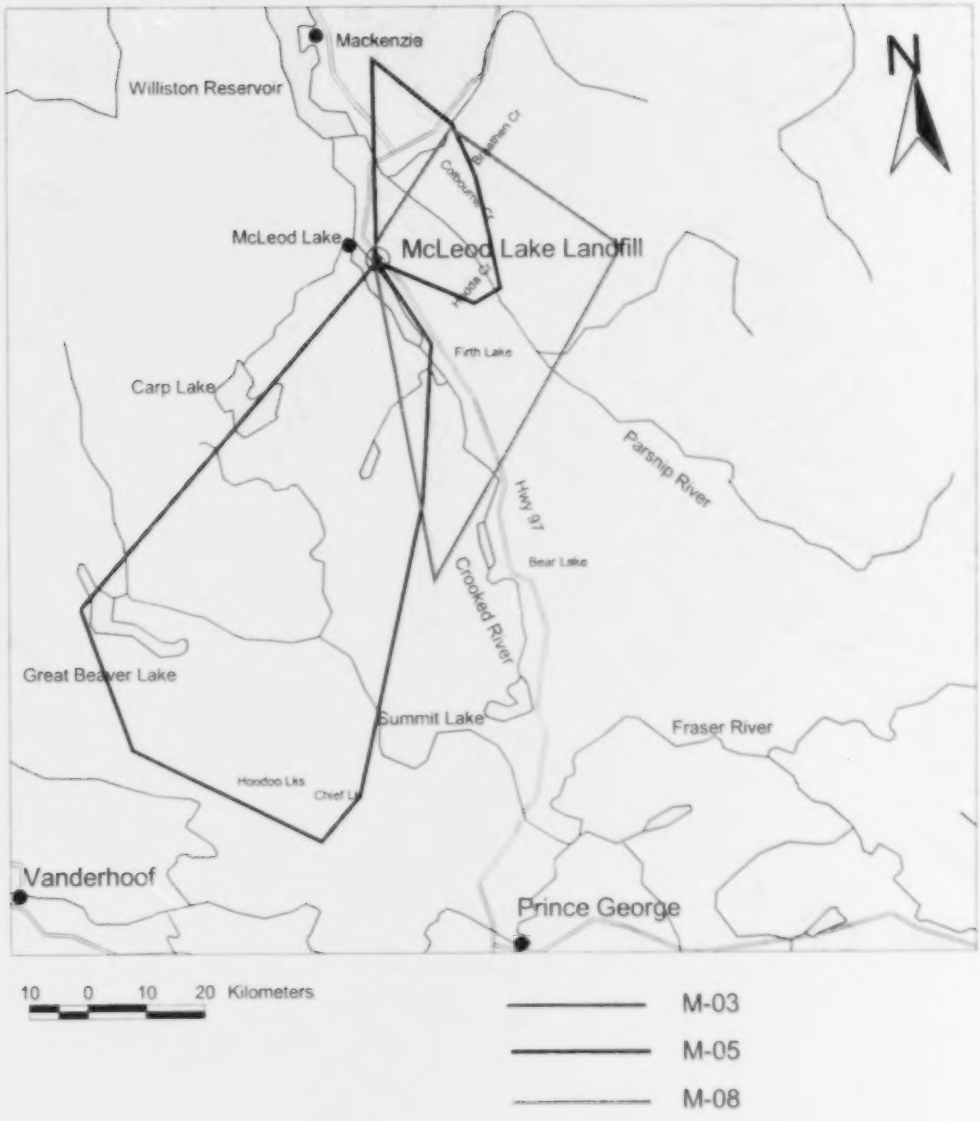

Figure 4. Annual home ranges of radio-tagged male grizzly bears that were captured at the McLeod Lake landfill, 2000.

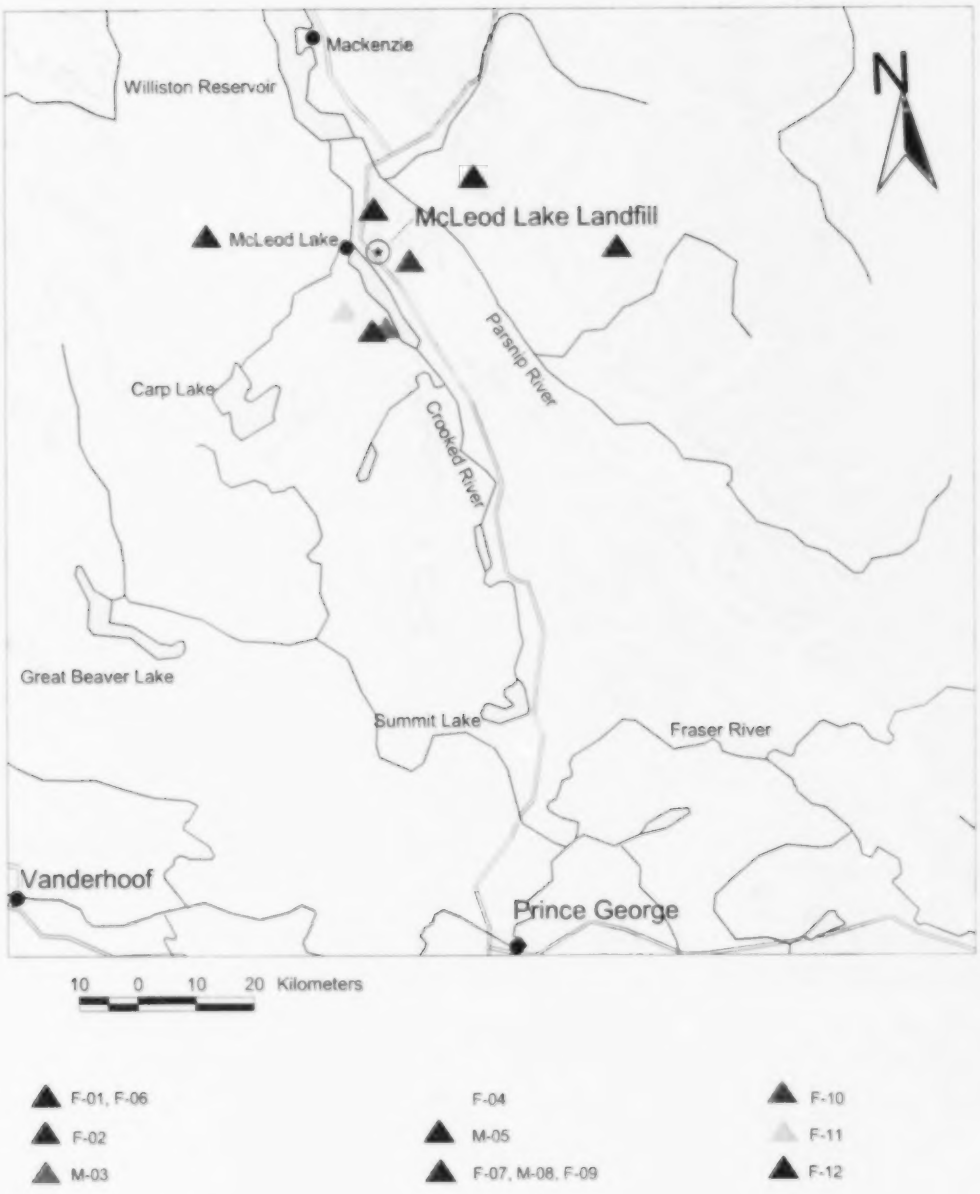

Figure 5. Den site locations of radio-tagged grizzly bears captured at the McLeod Lake landfill, 2000.

F02: 8-year-old adult female, no cubs in attendance

After her capture in the landfill in May, F02 moved to the Weedon Creek – Crooked River area southwest of McLeod Lake. She spent the first few weeks of summer along Hammett Creek, roughly 5 km west of McLeod Lake, before returning to the Weedon Creek – Crooked R area. In late summer (24 Aug), she started to re-visit the landfill but returned to the Weedon Creek area at least 3 times for short 1-day periods before the end of September. She was at the landfill almost continuously in late fall, with occasional excursions to sites along the western shore and northern tip of McLeod Lake, before returning to the Hammett Creek area to den in early November (Figure 5). Based on her observed movement patterns, she crossed the Crooked River and Hwy 97 a minimum of 7 times in 2000.

M03: 2-year-old male offspring of F02

Subadult male M03 travelled extensively across the plateau area southwest of McLeod Lake, thus (due to financial constraints) he was not consistently located throughout the monitoring period. According to the remote datalogger, M03 never returned to the landfill after his capture there in early spring. After capture, he moved west to Great Beaver Lake (25 May) and then south to the Hoodoo Lakes area northwest of Prince George where he remained for most of the summer (14 Jul – 16 Aug). In late August, M03 forayed northward to the west side of McLeod Lake; on 15 September, 4 datalogger fixes for M03 also positioned him west of McLeod Lake. In late September, he was again located in the area northwest of Prince George (north of Chief Lake), then he was not found again until 22 November when he was observed preparing a den west of McLeod Lake. Despite all his wanderings and relatively large home range, he returned to den only 1.4 km from his mother (F02) (Figure 5).

F04: 2-year-old female offspring of F02

F04 left the landfill area after capture in mid-May to spend the spring in the Weedon Creek-Crooked River-Hammett Creek area. She returned to the landfill for 2 days in early summer then travelled to the Carp Lake area 25 km west of McLeod Lake. She visited the landfill again for 2 days in early August before travelling approximately 12 km west of southern McLeod Lake. Her return route to the landfill in late summer was around the north end of McLeod Lake. In the fall she was consistently located by aerial telemetry within 2 km of the landfill; from mid-September through early November the landfill datalogger recorded her presence at the site daily. She denned west of McLeod Lake in mid-November, 3.1 km from her mother (F02) (Figure 5). The telemetry and datalogger data indicate that she crossed Hwy 97 at least 7 times in 2000.

F11: 2-year-old female offspring of F02

Bear F11, captured at the landfill in mid-September, remained within 2 km of the landfill until mid-November. The landfill datalogger recorded her presence at the site daily during this period. She crossed Hwy 97 to den in the Hammett Creek area, 5.9 km from her mother (F02) (Figure 5).

F09 / M08 / F07: Adult female (age unknown), with two 3-year-old cubs

The annual home range for this family unit primarily included the area between McLeod Lake and the Parsnip River, and from Firth Lake in the south to the Misinchinka River in the north. Adult female F09 and male cub M08 (both captured in the Firth Lake area in late May by the PGBP) used the area between Hodda Lake, Isadore Creek, and the Parsnip River throughout the spring. The bears used a larger area in summer, venturing north of Kennedy Siding to the Misinchinka River and southwest to the southern end of McLeod Lake. In late July, M08 separated from his mother, travelling to a location 13 km west of the community of Bear Lake. He rejoined his mother within a week, and both bears began to concentrate their movements around the landfill in mid-August. The landfill datalogger recorded their presence at the site periodically, for 1-2 days at a time, during the last 2 weeks of summer. Female cub F07 was observed from the aircraft with the sow and male cub on 5 occasions prior to her capture at the landfill in early September. The core area for the family unit in the fall focused on the landfill, and areas within 6 km north and northeast (toward Mt. Chingee) of the landfill. The landfill datalogger recorded an increasing length of visitation by these bears through September, with daily use of the landfill between late September and early November when they moved to den in the mountains 42 km east of the landfill (Figure 5). Three crossings of the Parsnip River by the family unit were documented by the telemetry data, and M08 crossed Hwy 97 at least twice during his summer foray west of Bear Lake.

F12: 5-year-old adult female with 2 COY

After capture in late September, F12 visited the landfill on 5 occasions, for periods of 1 to 5 days. When she was not at the landfill she used areas within 10 km north and west of the landfill. Radio-telemetry locations indicate that she crossed Hwy 97 at least 5 times before leaving the landfill area in early November. She moved northwest through Carp Lake Provincial Park and excavated a den site near Reed Creek, 28 km northwest of the landfill (Figure 5).

F10: 4-year-old female, no cubs

Adult F10, captured in early September, was predominantly located within 8 km east and southeast of the landfill throughout the fall. The landfill datalogger recorded her continuous use of the site from mid-September through mid-October. In late October she selected a den site 6 km east of the landfill (Figure 5).

M05: 17-year-old adult male

M05 ranged widely in spring, travelling north to at least the Mischinsinlika River, then returning to the north end of McLeod Lake before moving northwest to sites along the Misinchinka River (north of Kennedy Siding, toward the Pine Pass). Two 1-day visits to the landfill were recorded by the datalogger in spring: one prior to moving north to the Mischinsinlika River, and the second upon his return to McLeod Lake. He returned to the landfill in early summer, and was consistently located within 10 km east and northeast of the landfill for the remainder of the summer and into early fall. The datalogger recorded 3 periods of continuous landfill use during this time, lasting 9 (Jul), 17 (Jul-Aug), and 7 (Sep) days. In mid-September he left the landfill, crossed the Parsnip River and moved north to lower Colbourne Creek. He returned to the west side of the Parsnip River (near Hodda Creek), and traversed the Parsnip River a final time to reach the Braathen Creek valley where he denned (Figure 5). Since his capture in spring, he crossed the Parsnip River at least 7 times and Hwy 97 at least twice.

4.6.3 Movements to Den Sites

Most radio-tagged grizzly bears denned on the plateau, although one individual (M05) and one family group (F09/M08/F07) moved east to the western slopes of the Hart Ranges (Rocky Mountains) (Figure 5). The mean distance from the McLeod Lake landfill to den sites selected by radio-tagged grizzly bears was 16.4 km (range 6.3 – 41.7; n=9) (Table 9). Lone females were the first bears to reach den sites, followed by females with cubs, subadult females, and the adult male. The subadult male M03 was the last bear to enter into hibernation. Denning occurred as early as 1 November (F02, F10) and as late as 1 December (M03). The three 2-year-old cubs (M03, F04, and F11) that had been driven off by their mother (F02) in spring 2000, all returned to den in close proximity to their mother on the west side of McLeod Lake at 1.4, 3.1, and 5.9 km respectively. The two family groups (adult female F09 with cubs F07 and M08, and orphaned yearlings F01 and F06) denned communally at each of their selected sites.

4.7 Habitat Use

In spring, the majority of all radio-tagged grizzly bear locations obtained during aerial-telemetry were in coniferous or non-commercial forest habitats (77%; Figure 6). Use of these habitat types declined in summer and fall, while use of cutblocks increased. In summer, 74% of bear locations were in cutblocks and coniferous forests; use of these habitats increased to 82% in fall. All den sites were located in conifer-dominated stands. Bears used slightly higher elevations in summer

Table 9. Timing of movement between landfill and den sites, first date at den site, and distance between landfill and den sites for radio-tagged grizzly bears captured at the McLeod Lake landfill, 2000.

ID No.	Pre-denning movement dates[1]	First date at den site[2]	Distance from landfill to den site
F02	27 Oct – 1 Nov	1 Nov	11.3
M03	unknown	1 Dec	11.6
F04	11 – 18 Nov	18 Nov	8.5
M05	19 Sep – 9 Nov	9 Nov	22.2
F10	16 Oct – 1 Nov	1 Nov	6.3
F11	14 – 18 Nov	18 Nov	9.5
F12	5 – 18 Nov	18 Nov	28.1
F01[3]	15 – 22 Nov	22 Nov	8.7
F06[3]	15 – 22 Nov	22 Nov	8.7
F07[4]	5 – 18 Nov	18 Nov	41.7
M08[4]	5 – 18 Nov	18 Nov	41.7
F09[4]	5 – 18 Nov	18 Nov	41.7

[1]From last date recorded by datalogger at landfill, or last aerial radio-telemetry location near landfill
[2]Date of radio-telemetry flight when bear first recorded at den site
[3]Orphaned yearlings F01 and F06 denned together
[4]Adult female F09 and cubs F07 and M08 denned together

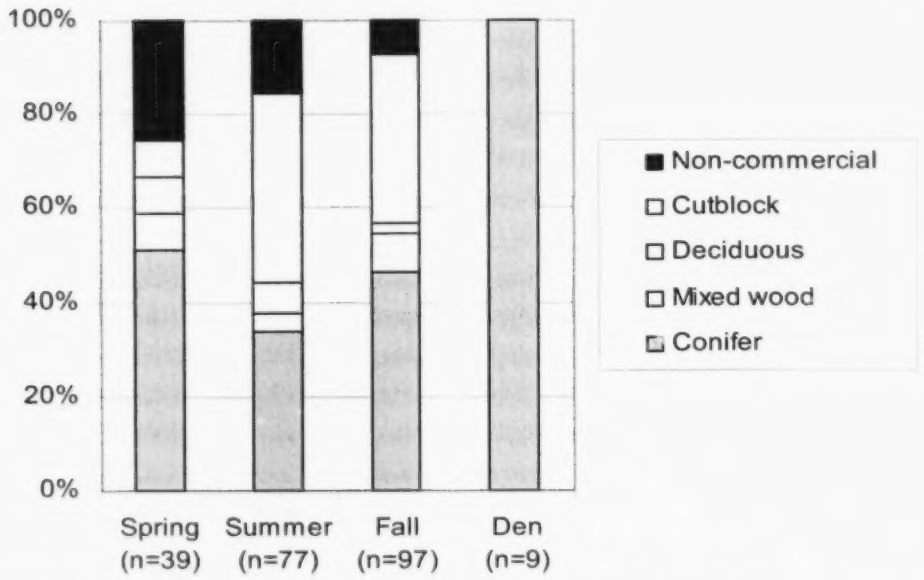

Figure 6. Habitat utilization by radio-tagged McLeod Lake grizzly bears (females and males combined) during the spring (den emergence – 30 Jun), summer (1 Jul – 31 Aug), and fall (1 Sep – denning) periods, and at denning, 2000.

(mean = 829 m ±132 SD; n=77) than in spring (mean = 800 m ± 138 SD; n=39) and fall (mean = 790 m ± 104 SD; n=97) (Figure 7).

Radio-tagged grizzly bears denned at higher elevations than those typically used throughout the year. The mean elevation of all den sites was 989 m ± 201 m S.D. (n=9) above sea level (asl), with a range of 800-1,400 m (Table 10). Den locations were primarily in mature coniferous forests on gentle to moderate slopes (Table 10).

Ground site investigations were conducted at 11 radio-tagged grizzly bear locations obtained by aerial telemetry: 2 in late spring, 2 in late summer, and 7 in fall (Table 11). At two of the sites (habitat plots #02-spring and #09-fall), no grizzly bear sign was detected despite a thorough search suggesting that the bears had spent a minimal amount of time in the area, or the GPS location obtained during the aerial telemetry flight was imprecise. At a third site (plot #10-fall), sign was observed but it could not be positively attributed to the grizzly of interest (F12). At this site, approximately 100 m east of Hwy 97 and 4.4 km northwest of the landfill, well-worn wildlife trails (generally oriented north-south) were evident, and the presence of a chewed plastic margarine container suggested a travel route to and from the landfill. Abundant black huckleberry (*Vaccinium membranaceum*) was present in the area, but most of the shrubs were without berries or leaves when the site was visited thus feeding on this vegetation by grizzly bears could not be confirmed. Grizzly bear activity observed at the remaining 8 sites investigated involved feeding (3 sites), resting (1 site), and travelling (4 sites). Travel sites were identified by the presence of grizzly bear track imprints or shed hair and the apparent absence of significant feeding or resting sign. Two of these sites were locations where grizzlies F02 and M03 dropped their radio-collars. Both radio-collars were torn where the fire-hose spacers had rotted, and both were retrieved from openings adjacent to shrub habitats.

In spring, plot #01 revealed that grizzly bear F04 had been feeding on a moose carcass. At summer habitat plots (#03 [F02] and #04 [M03]) conducted in late August, feeding and travelling sign were observed respectively. F02 apparently consumed clasping twisted-stalk (*Streptopus amplexifolius*), false solomon's-seal (*Smilacina racemosa*), black gooseberry (*Ribes lacustre*), and highbush-cranberry (*Viburnum edule*) at plot #03; evidence of foraging for ants was also noted. Plot #04 was conducted where bear M03 dropped his radio-collar; he lost it while travelling through a riparian gully that was thick with devil's club (*Oplopanax horridus*).

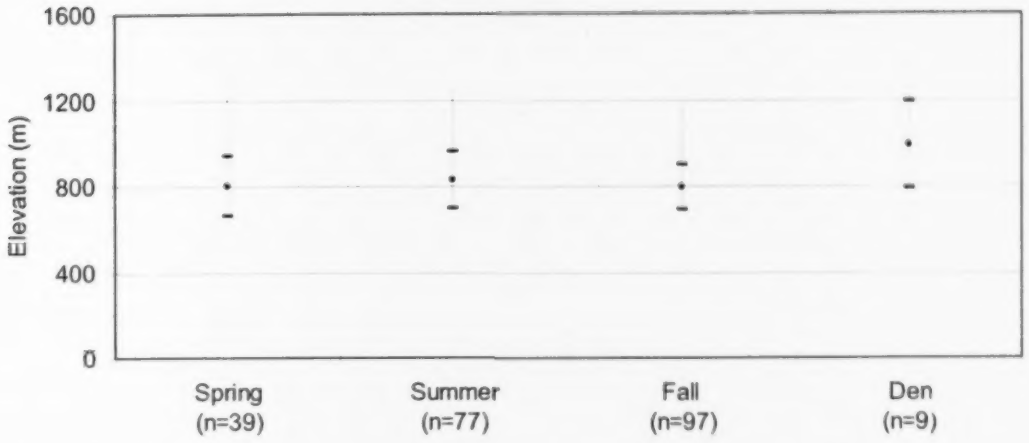

Figure 7. Mean elevation ± 1 SD (metres above sea level) used by radio-tagged McLeod Lake grizzly bears during spring (den emergence – 30 Jun), summer (1 Jul – 31 Aug), and fall (1 Sep – denning) periods, and at denning, 2000. Lines depict range of elevations used.

Table 10. Den site characteristics (determined through aerial-telemetry) for radio-tagged grizzly bears captured at the McLeod Lake landfill, 2000. Slope, aspect and canopy cover were visually estimated during telemetry flights; elevation was derived from 1:50,000 topographic maps.

ID No.	Elev (m)	Slope[1]	Aspect	Canopy cover (%)	Habitat description
F01, F06	850	Moderate	N	10-15	Open spruce-pine forest
F02	850	Steep	NE	15-20	Mature spruce-leading conifer forest
M03	900	Gentle	E	5-10	Mature spruce forest adjacent to shrubby meadow
F04	900	Moderate	W	15	Douglas-fir and pine forest
M05	1,100	Moderate	SE	10	Mature spruce-leading forest with large shrubby openings
F07, M08, F09	1,400	Steep	SE	60	Mature spruce forest
F10	900	Gentle	S	30	Along a creek draw in mature spruce-leading conifer forest
F11	800	Moderate	NE	15-20	Along a small creek draw in mature spruce-dominated forest
F12	1,200	Gentle	SW	5	Along a creek draw in balsam and spruce-dominated forest

[1]Gentle = estimated <10° slope; Moderate = estimated 10-30° slope; Steep = estimated 30 -40° slope.

Table 11. Grizzly bear activity observed at ground investigations of selected aerial-telemetry locations of radio-tagged grizzly bears that were captured at the McLeod Lake landfill, 2000.

Plot No.	ID No.	Telemetry Date	Plot Date	Distance from landfill (km)	Activity observed
Spring					
01	F04	19 Jun	6 Jul	17.3	Feeding
02	F01, F06	29 Jun	6 Jul	1.3	None
Summer					
03	F02	24 Aug	3 Sep	3.9	Feeding
04	M03	30 Aug	7 Sep	7.5	Traveling
Fall					
05	F10	13 Sep	20 Sep	11.2	Resting
06	F02	13 Sep	20 Sep	16.9	Feeding
07	F02	6 Sep	20 Sep	18.7	Traveling
08	M03	27 Sep	11 Oct	80.2	Traveling
09	M05	4 Oct	14 Oct	20.2	None
10	F12	10 Oct	16 Oct	4.4	None
11	F12	9 Nov	13 Nov	23.5	Traveling

Feeding (1 plot), resting (1 plot), and travelling (3 plots) sign were identified at sites investigated in the fall. F02 fed on velvet-leaved blueberry (*Vaccinium myrtilloides*) as well as false solomon's seal in mid-September (plot #06). Plot #05 (F10) was a resting site, as indicated by the presence of an apparent day bed with 3 grizzly bear scats within a 1-m radius of the bed. The bed was in an aspen-dominated forest, on a small bench mid-way up a steep west-facing slope. Bears F02 (plot #07), M03 (plot #08), and F12 (plot #11) were travelling through sites that were investigated between late September and mid-November. F02's dropped radio-collar was found at her site, in a narrow clearing of dwarf blueberry (*V. caespitosum*) and black twinberry (*Lonicera involucrata*) between a patch of thick willows (*Salix* sp.) and a stand of young conifers.

4.8 Transmitter Evaluation

As an ad-hoc trial to ascertain radio-transmitter performance, the adult male grizzly bear (M05) was fitted with a radio-collar, an ear-tag transmitter programmed to work during the daytime (0900 – 1700) on weekdays (Monday to Friday), and an ear-tag transmitter programmed to start in April 2001. The frequencies of both the radio-collar and daytime-weekday ear-tag transmitter were entered into the landfill datalogger to provide a comparison of signal strengths of each transmitter type, and to verify on/off times of the ear-tag transmitter. Overall, the daytime-weekday ear-tag transmitter was found to perform satisfactorily. The transmitter turned on and off daily as scheduled (e.g., on 2 Aug 2000: first record logged at 0907, last record at 1650 based

on 10-minute scanning interval of datalogger). Signal strengths for the daytime-weekday ear-tag transmitter varied, but were more often slightly greater than the signal strengths recorded for the radio-collar (Table 12). In addition, M05's ear-tag transmitter signal was often received before his radio-collar signal during aerial-telemetry flights. These stronger signals may be a result of the ear-tag transmitter's antenna being both external and positioned higher on the bear's body. In addition, M05's ear-tag signal was often received before the radio-collar signal during fixed-wing telemetry flights. Negative effects of attaching ear-tag transmitters to bears was discussed previously in section 4.1.2 *Capture Related Injuries*.

Table 12. Field examples of signal strengths from radio-collar and ear-tag transmitters attached to M05 as recorded by the 3 directional antennas connected to the landfill datalogger. Example records from 11 Sep 2000, each record separated by 10 minutes.

	Signal Strengths		
	Antenna 1	Antenna 2	Antenna 3
Record 1			
Radio-collar	-	78	132
Ear-tag transmitter	-	93	139
Record 2			
Radio-collar	58	99	149
Ear-tag transmitter	-	110	155
Record 3			
Radio-collar	-	86	145
Ear-tag transmitter	-	111	155

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APPENDIX A. Number of grizzly bear captures during each trapping session at the McLeod Lake landfill, spring and fall 2000.

	Spring			Fall			
ID No.	Session 1 25 Apr–5 May	Session 2 9 May- 9 May	Session 3 23 May-30 May	Session 4 29 Aug-8 Sep	Session 5 12 Sep-22 Sep	Session 6 25 Sep-5 Oct	Total
F-01	1		2	1			4
F-02	1			1	5	2	9
M-03		1					1
F-04		2		1	2	2	7
M-05			1		1		2
F-06			1			3	4
F-07				1	2	3	6
M-08				2			2
F-09				2		2	4
F-10				2			2
F-11					1	1	2
F-12						1	1
M-13						1	1
Total	2	3	4	10	11	15	**45**

APPENDIX B. Capture dates and trap type for grizzly bears and wolves captured at the McLeod Lake landfill in spring and fall 2000. The majority of captures were overnight, thus the exact date of capture is often unknown. The Capture Date used is the date of the trapping evening, although the bear was usually processed the subsequent morning.

ID No.	No. of Captures	Capture Date and Trap Type[1]								
		1	2	3	4	5	6	7	8	9
F01	4	29-Apr S	27-May C	29-May CB	5-Sep S					
F02	9	30-Apr S	6-Sep C	13-Sep S	16-Sep C	17-Sep S	20-Sep C	21-Sep C	26-Sep C	29-Sep C
M03	1	9-May S								
F04	7	9-May S	14-May CB	29-Aug C	12-Sep S	18-Sep C	28-Sep C	2-Oct CB		
M05	2	23-May S	14-Sep C							
F06	4	27-May C	25-Sep C	1-Oct C	2-Oct C					
F07	6	31-Aug S	17-Sep S	20-Sep C	27-Sep C	30-Sep C	2-Oct C			
M08[2]	2	31-Aug C	3-Sep S							
F09[3]	4	1-Sep S	7-Sep C	28-Sep C	1-Oct C					
F10	2	1-Sep C	6-Sep S							
F11	2	18-Sep C	25-Sep C							
F12	1	27-Sep S								
M13	1	1-Oct S								
W-1[4]	1	1-Sep S								
W-2[4]	1	3-Sep S								
W-3[4]	1	28-Sep S								

[1] C = Culvert trap, baited; S = Aldrich snare, trail set; CB = Aldrich snare, baited cubby set

[2] Previously captured by PGBP on 25 May 2000 using baited cubby snare set near Firth Lake

[3] Previously captured by PGBP on 25 May 2000 by aerial darting near Firth Lake

[4] Wolves captured incidentally during grizzly bear trapping

APPENDIX C. Administered drug dosages and immobilization sequences for grizzly bears captured at the McLeod Lake landfill in spring and fall 2000.

ID No.	Capture Date	Weight (kg)	1st Dose				2nd Dose			
			Method[1]	Dose (mg)[2]	Time	Comment	Method	Dose (mg)	Time	Comment
F01	29-Apr	38.0	Dart	T 340	0629	*only received 125 mg	Hand	K 0.8 cc	0653	still movement
	29-May	~45.0	Jab	T 160	?	not down completely	Jab	T 140	?	induction 2.0 min
	5-Sep	90.5	Dart	T 500	2105	induction 5.0 min				
F02	30-Apr	175.0	Dart	T1500	0700	induction 3.5 min				
	6-Sep	220.0	Jab	T1455	0838	unknown amt received	Jab	T1000	0858	still active
	13-Sep	~225.0	Dart	T1000	0735	moved head, pierced ear	Dart	T1315	0808	faulty charge
	17-Sep	~225.0	Dart	T1500	0715	still alert	Dart	T1000	0735	induction 3.0 min
M03	9-May	117.0	Dart	T 675	0741	induction 2.0 min				
F04	9-May	86.0	Dart	T 350	0927	induction 3.0 min				
	12-Sep	148.0	Dart	T1000	0747	unknown amt received	Dart	T 775	0804	induction 4 min
	2-Oct	~155.0	Dart	T 960	0819	induction 9.0 min				
M05	23-May	~ 382.5	Dart	T1610	0849	induction 6.0 min	Hand	T 500	0909	
	14-Sep	343.2	Jab	T2000	1322	unknown amt received	Dart	T2000	1329	still head movement
F06	27-May	51.0	Jab	T 300	1957	induction 2.0 min	Hand	K 1.0cc	2034	lots of movement
	25-Sep	112.0	Jab	T 770	0729	still some movement	Jab	T 410	0751	still head movement
F07	31-Aug	112.5	Dart	T 825	0707	still head movement	Hand	T 500	0743	
	17-Sep	~120.0	Dart	T 775	2021	induction 3.0 min				
M08	31-Aug	145.0	Jab	T 870	1000	unknown amt received	Jab	T 555	1023	induction 2.5 min
F09	1-Sep	176.5	Dart	T1000	2117	induction 5.0 min	Hand	T1000	2220	into culvert for night
F10	1-Sep	193.0	Jab	T 600	0636	still head movement	Hand	T 400	0654	still active
	6-Sep	193.0	Dart	T1000	0701	still head movement	Hand	T 500	0723	still licking
F11	18-Sep	117.0	Jab	T 500	0722	movement after 20 min	Hand	T 415	0751	head move in 1/2 hr.
F12	27-Sep	165.0	Dart	T1285	0725	still head movement	Jab	T 500	0748	
M13	1-Oct	33.0	Jab	T 220	0709	induction 3.0 min				

Continued.....

APPENDIX C continued.

ID No.	Capture Date	3rd Dose Method	3rd Dose (mg)	3rd Dose Time	3rd Dose Comment	4th Dose Method	4th Dose (mg)	4th Dose Time	4th Dose Comment	5th Dose Method	5th Dose (mg)	5th Dose Time	5th Dose Comment
F01	29-Apr	Hand	T 170	0714	went down quickly								
	29-May												
	5-Sep												
F02	30-Apr												
	6-Sep	Jab	T1000	0922	movement w/in 3/4 hr.								
	14-Sep	Dart	T1000	0859	still some movement	Jab	T 940	0914	induction 5.0 min				
	18-Sep												
M03	9-May												
F04	9-May												
	13-Sep	Hand	T 225	0903	some movement								
M05	23-May												
	17-Sep	Jab	T1500	1349	still head movement	Jab	T1500	1404					
F06	27-May												
	27-Sep	Jab	T 320	0806	still head movement	Hand	T 280	0823	still head movement	Hand	T 220	0835	slow recovery
F07	31-Aug												
	17-Sep												
M08	31-Aug	Hand	T 370	1046	could sit w/in 1 hour								
F09	1-Sep	Jab	T1000	1024	Induction 3.0 min[3]								
F10	1-Sep	Hand	T 500	0709	still active	Hand	T 290	0742	still active	Hand	T 390	0829	recovered quickly
	6-Sep	Hand	T 225	0733	movement w/in 1/2 hr.								
F11	25-Sep												
F12	1-Oct												
M13	2-Oct												

[1]Method: Dart = Dart from CO2 pistol; Jab = Jabstick with syringe; Hand = Hand injection with syringe

[2]Dose: T = Telazol®; K = Ketaset®

[3]F09 spent the night in culvert trap after 1st and 2nd dosages; 3rd dosage administered the following morning

APPENDIX D. Physical characteristics of grizzly bears captured at the McLeod Lake landfill in spring and fall 2000.

ID No.	Capture Date	Foot Snared	Body Condition	Hair Color/Length	Tooth Condition/Wear	Wounds
F01	29-Apr	?	Poor, no fat	Blond	No missing/broken teeth	Left hind leg wounded, broken at knee, appears 4 buckshot wounds, holes look fresh but leg appears set
	5-Sep	R front	Good (Exc)	Blond, long	Good teeth	Leg healed, was set and moveable, walks on front portion of hind pad only; replaced eartag transmitter, inside pussy, red, & swollen, circular knob of raw tissue visible on either side
F02	30-Apr	?	Good	Brown	No missing/broken teeth; wear low-med	
	6-Sep	-	Good - Exc	Br, blond streak below shoulder, slightly shorter than other bears	More worn teeth than other bears; chip/wear on back of R canine	Sore patch inside left leg/groin area
M03	9-May	?		LtBr/drk legs, coarse short on shoulders/hips	Teeth older looking	
F04	9-May	?		LtBr, hair loss & coarse short hair many places	Teeth young, good	
	12-Sep	R front	Good	LtBr, lt face/neck, behind/below shoulder, longer than spring but still short, hump prominent darker due to long hair	Small/good/young, bit of wear, R PM missing	Large, round, hard abcess on left nose, above mouth 1"; ears very festered & raw from eartags
M05	23-May	L front	(Excellent)	Br, long; blonde chest, face, neck, armpits	Old & worn	Bleeding from mouth; top left canine split 30% loss, fracture length of tooth; left front foot 3" laceration by teeth; claw missing right front foot
	14-Sep	-	Good but thinner, collar loose	Brown	Very poor condition, all canines broken off, many incisors missing	Eartags caused raw, soreness; ripped claw R front foot;

Continued.....

APPENDIX D. continued.

ID No.	Capture Date	Foot Snared	Body Condition	Hair Color/Length	Tooth Condition/Wear	Wounds
F06	27-May	-		Lt on back, Br w/ Lt on chin/chest	Teeth young, good, lower canines blunted	Injury mid back near spine, matted hair, blood, mucus at anterior end, possible buckshot wound
	25-Sep	-	Good (Exc)	Very blond now, darker on top, really dark legs	Exc, appears to have regrown left PM	Wound on back very evident, lots pus, obvious angled puncture hole (buckshot?), smelled strong; ears not as swollen & raw as Nutmeg but still matted blood/pus & raw
F07	31-Aug	R front	Good	Br w/ Lt on back/neck, long	1st left molar hanging (removed), minor wear, front lower incisors slightly worn	1st left molar; right front ankle severe injury, chewed through bone
	17-Sep	L front	(Fair - Good)			Right foot, more exposed flesh now almost to claw on inside, raw & bloody (possibly chewing on it)
M08	31-Aug	-		Lt upper body, v. drk legs	Lower L canine v. worn (1/2 size of other); no incisors lower jaw, upper L PM1 missing (prob. previous capture)	Two claws bleeding, right front foot
F09	1-Sep	R front	Good	Drk brown, blond tips, long	Upper L PM1 missing (*prob. previous capture)	Small abrasion right front upper foot; puncture wound right side of tongue
F10	1-Sep	-	Excellent	Typical grizzly, LtBr back & chest, black legs	Minimal wear, canines good, incisor small & broken off	Fair amount soreness along neck (poss. Previous collar?); L front pad cut; sore on upper neck
F11	18-Sep	-	Fair	Br, short back, long hump & front	Young good teeth	None
F12	27-Sep	R front	Good	Br, v.blond stripe behind shoulder, lighter top of head; shorter hair on back	Good teeth, top R canine chipped & worn	1 cm cut from snare cable, sm cut lower lip
M13	1-Oct	L front, high	Fair	Brown, long	V. young, good clean teeth	Small wound inside upper left leg

APPENDIX E. Physical measurements of grizzly bears captured at the McLeod Lake landfill in spring and fall 2000.

ID	Capture		Body Measurements							Foot Measurements								
										Front Pad (cm)					Rear Pad (cm)			
No.	Date	Age	Weight (kg)	Total Length (cm)	Tail (cm)	Chest (cm)	Abdom (cm)	Neck (cm)	Head Length (cm)	Foot	Width	Length	L w/toes	Claw	Foot	Width	Length	L w/toes
F01	29-Apr	1	38.0	135.0		74.0			31.0	?	11.5		9.5		R	9.5		17.5
	5-Sep	1	90.5	170.0	9.0	93.0	112.0	55.0		R	12.3	7.0	12.4	7.3	R	11.2	16.4	22.0
F02	30-Apr	8	175.0	204.0		122.0			36.0	R	15.0		14.0	10.0				
	6-Sep	8	220.0	198.0	9.0	134.0	162.0	74.0		L	14.1	8.4	14.5	8.3	R	13.5	19.8	24.9
M03	9-May	2	117.0	182.0		104.0		61.0		?	14.5		12.0	8.5	?	13.4		24.6
F04	9-May	2	86.0	176.0		89.0		53.0	33.5	?	12.5		10.5	8.2	?	11.5	16.5	
	12-Sep	2	148.0	187.0	11.0	113.0	139.0	67.5		L	13.1	7.5	13.0	10.2	R	12.7	17.4	22.6
M05	23-May	17	382.5[1]	235.0		156.5			44.0	R	16.3	9.0	15.0	7.8	L	15.0	23.0	29.0
	14-Sep	17	343.2	231.0	10.0	152.0	195.0	90.0		R	15.8	9.3	15.3	6.8	R	15.2	23.0	28.6
F06	27-May	1	51.0	140.0		79.5			30.5	L	11.0		9.0	5.3	?	9.5	14.0	19.0
	25-Sep	1	112.0	163.5	10.0	110.0	128.0	60.0	38.0	R	12.0	6.2	11.0	6.8	R	11.8	16.5	21.0
F07	31-Aug	3	112.5	191.0	11.0	96.0	117.0	62.5	37.5	L	12.8	7.0	13.2	7.3	R	11.6	17.5	22.0
M08	31-Aug	3	145.0	200.0	11.5	106.0	127.0	64.0	39.5	L	14.5	8.8	14.8	7.5	R	13.0	17.6	23.5
F09	1-Sep	n/a	176.5	201.0	10.0	122.0	139.0	68.0	39.0	R	13.5	8.5	14.5	8.4	R	11.5	18.0	24.0
F10	1-Sep	4	193.0	206.0	7.0	128.0	152.0	69.0	34.5	R	14.5	8.0	13.5	7.8	R	12.8	18.2	22.8
F11	18-Sep	2	117.0	170.5	11.5	100.0	119.0	59.0	40.0	R	13.0	7.0	12.3	6.4	R	12.3	17.0	22.6
F12	27-Sep	5	165.0	210.0	14.0	118.0	135.0	70.0	26.0	L	13.7	8.5	13.7	10.4 (R)	R	13.6	18.2	23.5
M13	1-Oct	0	33.0	120.0	6.5	65.0	73.0	39.0		R	9.4	5.3	9.3	5.2	R	8.6	11.7	16.0

[1]Based on chest girth/weight relationship (Jonkel 1992)

Continued.....

APPENDIX E continued.

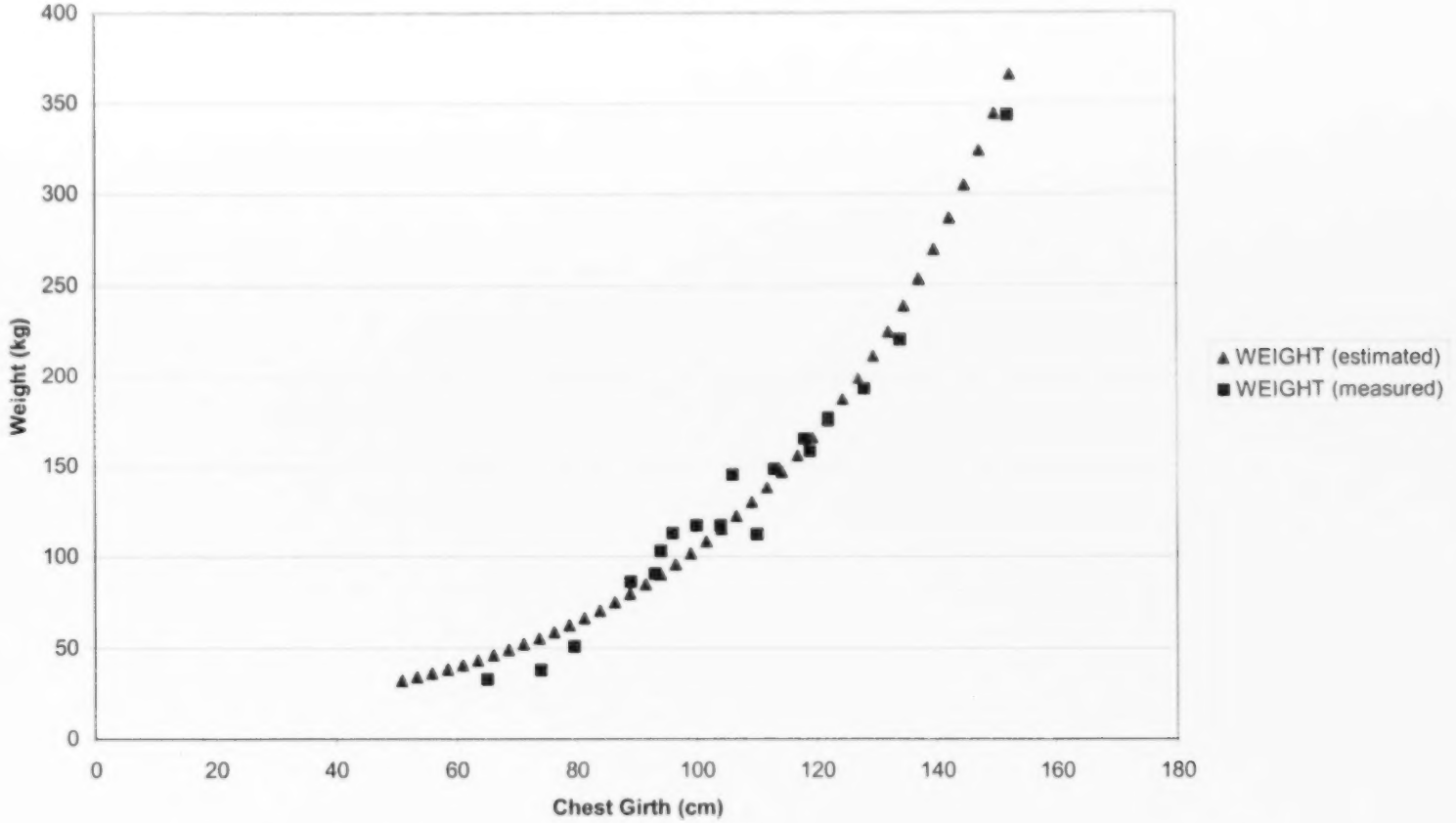
ID No.	Capture Date	Age (actual)	Weight (kg)	Dentition			Reproductive Parts: Measurements and Status							
				Canine (cm)			Baculum	Testes (cm)		Nipple (cm)				Vulva
				Length	Width	Intercanine	Length	Length	Width	Length	Width	Color	Lactating?	Condition
F01	29-Apr	1	38.0			3.4								
	5-Sep	1	90.5	2.1	1.5	5.4								
F02	30-Apr	8	175.0			6.0								
	6-Sep	8	220.0	3.0	1.8	6.6 approx				1.3	1.1	brown	N	very pink
M03	9-May	2	117.0											
F04	9-May	2	86.0											
	12-Sep	2	148.0	2.5	1.6	5.7				1.0	0.7		N	pale pink
M05	23-May	17	~ 382.5			7.0								
	14-Sep	17	343.2	1.6	2.3	6.5 approx	18.0	9.0	5.0					
F06	27-May	1	51.0											
	25-Sep	1	112.0	2.8	1.7	5.4				0.7	0.6		N	
F07	31-Aug	3	112.5	2.7	1.7	5.7				1.2	0.8	pink/brown	N	small, pinkish
M08	31-Aug	3	145.0	3.4	2.0	5.9	18.0	6.0	3.0					
F09	1-Sep	n/a	176.5	3.0	2.0	6.1 approx				1.4	1.2	brown	N	dull pink
F10	1-Sep	4	193.0	2.9	1.6	5.8				1.7	1.4	brown	N	pink
F11	18-Sep	2	117.0	2.7	1.7	5.4				1.0	0.6	flesh/pink	N	good, pink
F12	27-Sep	5	165.0	2.6	1.7	5.8				1.6	1.4	drk brown	Y	pink, bit red/raw
M13	1-Oct	0	33.0	1.2	0.6	4.1								

APPENDIX F. Biological samples collected and antibiotic treatments administered for grizzly bears captured at the McLeod Lake landfill in 2000.

ID No.	Capture Date	Blood		Hair	Claw	Fecal	Biopsy[1]	Tooth	Biomycin (cc)
		Red	Purple						
F01	29-Apr	Y	Y	Y	Y	N	Y	U,L PM1	3.5
F02	30-Apr	N	N	Y	Y	Y	Y	U,L PM1	8.0
M03	9-May	N	N	Y	Y	Y	Y	Y	6.0
F04	9-May	N	N	Y	Y	Y	Y	U,R PM1	5.0
M05	23-May	Y	Y	Y	Y	N	Y	Y	8.0
F06	27-May	Y	Y	Y	Y	Y	Y	L side	5.5
F07	31-Aug	Y	Y	Y	Y	N	Y	L, L 1st M	20.0
M08	31-Aug	Y	Y	Y	Y	N	Y	U,R PM1	N
F09	1-Sep	Y	Y	Y	Y	N	N	N	N
F10	1-Sep	Y	Y	Y	Y	N	Y	Y	6.0
F11	18-Sep	Y	Y	Y	Y	N	Y	U,R PM1	6.0
F12	27-Sep	Y	Y	Y	Y	N	Y	U,R PM1	10.0
M13	1-Oct	Y	Y	Y	Y	N	Y	N	3.0
F01	5-Sep	N	N	N	N	N	N	N	N
F02	6-Sep	Y	Y	N	N	N	N	N	5.0
F04	12-Sep	Y	Y	N	N	N	N	N	10.0
M05	14-Sep	Y	Y	N	N	N	N	N	10.0
F07	17-Sep	N	N	N	N	N	N	N	16.0
F06	25-Sep	Y	Y	N	N	N	N	N	7.0

[1]Biopsy sample obtained from ear tissue

APPENDIX G. Measured chest girth/weight relationship for McLeod Lake grizzly bears, 2000. (Estimated chest girth/weight relationship for grizzly bears from Jonkel 1992.)



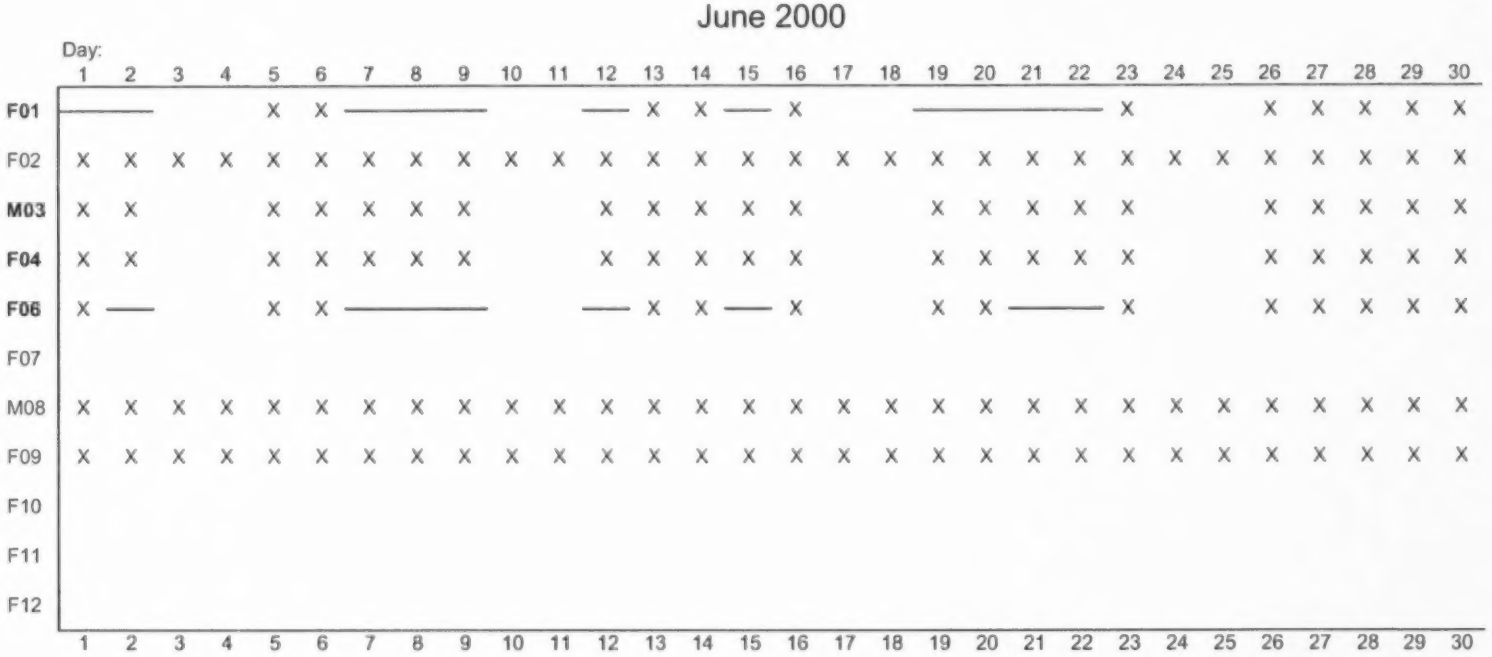
Weight (measured): Actual measured weight of grizzly bear
Weight (estimated): Weights obtained from "Chest Girth/Weight Relationship" table (Jonkel 1992)

APPENDIX H. Type of radio transmitter and season of attachment for grizzly bears captured at the McLeod Lake landfill in 2000.

ID No.	Age	Spring				Fall (Change #1)				Fall (Change #2)			
		Radio collar[1]		Ear-tag[2]		Radio collar		Ear-tag		Radio collar		Ear-tag	
		collar	firehose	ON	OFF	collar	firehose	ON	OFF	collar	firehose	ON	OFF
F-01	1			✓	✓			R	NC				
F-02	8	✓	3			R	4						✓
M-03	2	✓	2+T	✓									
F-04	2			✓	✓	✓		X	R				
M-05	17	✓	3	✓	✓								
F-06	1			✓				R	✓				
F-07	3							✓	✓				
M-08	3	✓	?						✓				
F-09	n/a	✓	4										
F-10	4					✓	3						✓
F-11	2							✓	✓				
F-12	5					✓	4		✓				
M-13	0												

[1]Radio collars attached with different number of layers of firehose as specified; T = duct tape wrapped around layers as well
[2]ON = transmitters emitting signals (daytime-weekday or 24 hr); OFF = transmitters not emitting signals (programmed to turn on April 01)
→ = Transmitter placed on for the first time
R = Transmitter replaced by identical type
X = Transmitter removed from animal
NC = Transmitter remained on animal (no change)

APPENDIX I. Use of McLeod Lake landfill by radio-tagged grizzly bears in June 2000



*Bears in **boldface** wore daytime-weekday ear-tag transmitters (until replaced); all other bears wore 24-hr transmitters (ear-tag or radio collar)

Bear first captured (Bears F01, F02, M03, F04, M05, and F06 were first captured in the landfill in May 2000; Bears M08 and F09 were first captured at Firth Lake in May 2000)

Bear re-captured in landfill

Bear re-captured in landfill: daytime-weekday ear-tag transmitter replaced by 24-hr transmitter (ear-tag or radio collar)

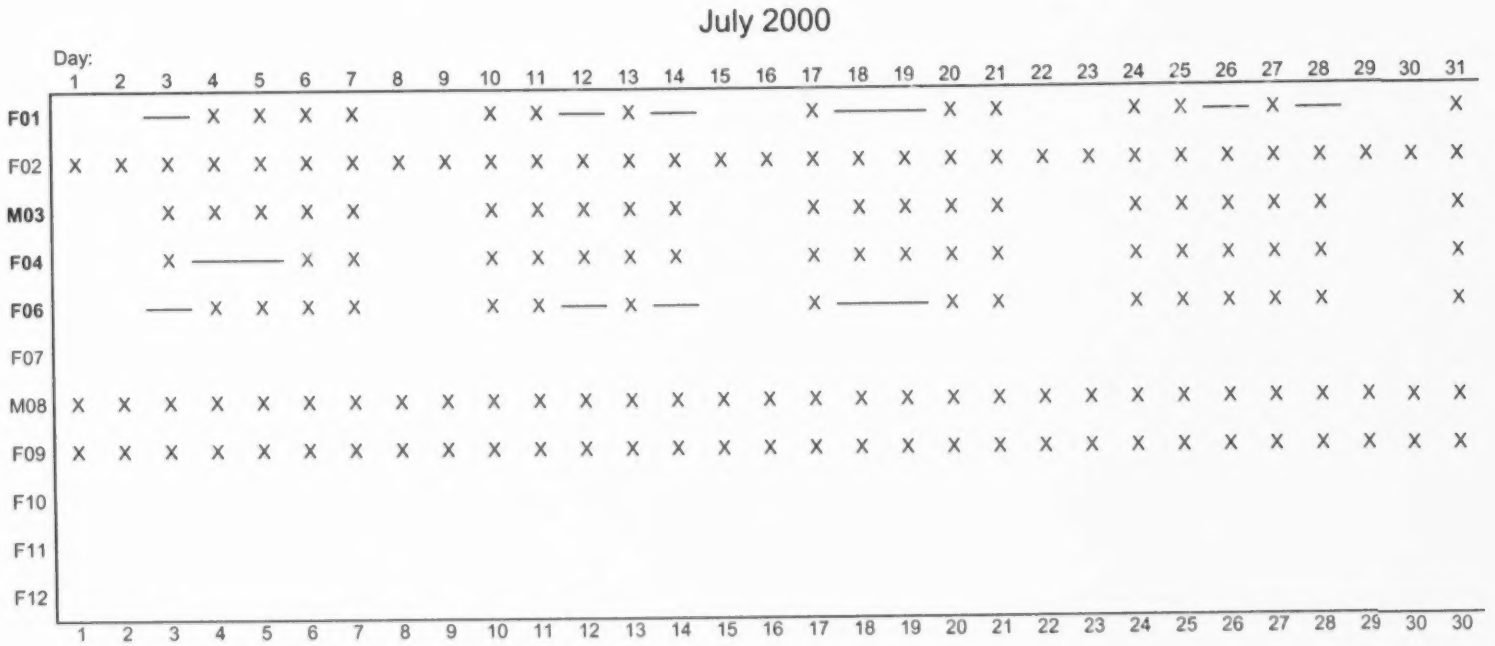
Bear visited landfill for last time in 2000

—— Bear used landfill (in vicinity of landfill during the day for bears wearing daytime-weekday transmitters, in landfill at night for all others)

X Bear did not use landfill

blank cell Not applicable: bear not radio-tagged, datalogger not working, ear-tag transmitter turned off, or transmitter dropped off

APPENDIX J. Use of McLeod Lake landfill by radio-tagged grizzly bears in July 2000


July 2000
Day:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
F01 — X X X X — — X X — X — X X — — — X X X X X — — X
F02 X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X
M03 X X X X X X X X X X X X X X X X X X X X X X X X X
F04 X — — — X X X X X X X X X X X X X X X X X X X X X
F06 — X X X X X X X — X — X — X X X — — X X X X X X
F07
M08 X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X
F09 X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X
F10
F11
F12
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 30

*Bears in **boldface** wore daytime-weekday ear-tag transmitters (until replaced); all other bears wore 24-hr transmitters (ear-tag or radio collar)

Bear first captured (Bears F01, F02, M03, F04, M05, and F06 were first captured in the landfill in May 2000; Bears M08 and F09 were first captured at Firth Lake in May 2000)

Bear re-captured in landfill

Bear re-captured in landfill: daytime-weekday ear-tag transmitter replaced by 24-hr transmitter (ear-tag or radio collar)

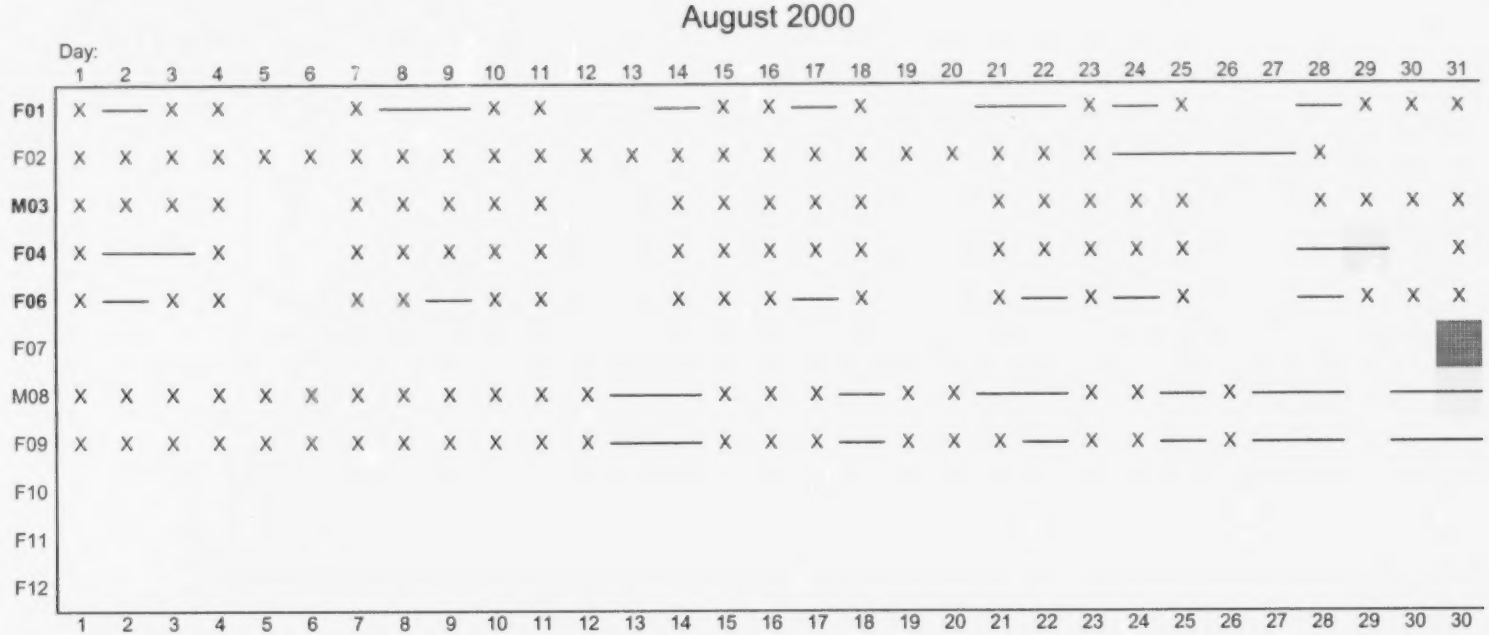
Bear visited landfill for last time in 2000

— Bear used landfill (in vicinity of landfill during the day for bears wearing daytime-weekday transmitters, in landfill at night for all others)

X Bear did not use landfill

blank cell Not applicable: bear not radio-tagged, datalogger not working, ear-tag transmitter turned off, or transmitter dropped off

APPENDIX K. Use of McLeod Lake landfill by radio-tagged grizzly bears in August 2000



*Bears in **boldface** wore daytime-weekday ear-tag transmitters (until replaced); all other bears wore 24-hr transmitters (ear-tag or radio collar)

Bear first captured (Bears F01, F02, M03, F04, M05, and F06 were first captured in the landfill in May 2000; Bears M08 and F09 were first captured at Firth Lake in May 2000)

Bear re-captured in landfill

Bear re-captured in landfill: daytime-weekday ear-tag transmitter replaced by 24-hr transmitter (ear-tag or radio collar)

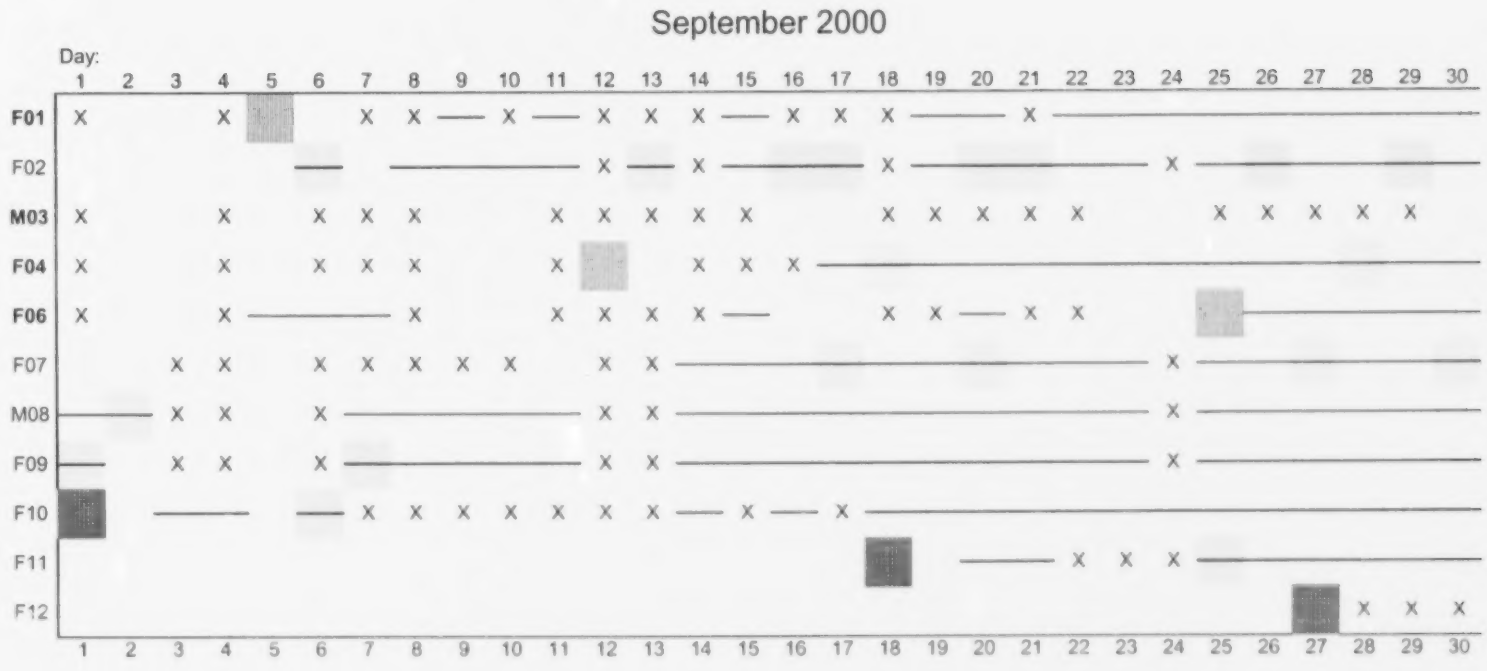
Bear visited landfill for last time in 2000

—— Bear used landfill (in vicinity of landfill during the day for bears wearing daytime-weekday transmitters, in landfill at night for all others)

X Bear did not use landfill

blank cell Not applicable: bear not radio-tagged, datalogger not working, ear-tag transmitter turned off, or transmitter dropped off

APPENDIX L. Use of McLeod Lake landfill by radio-tagged grizzly bears in September 2000



*Bears in **boldface** wore daytime-weekday ear-tag transmitters (until replaced); all other bears wore 24-hr transmitters (ear-tag or radio collar)

Bear first captured (Bears F01, F02, M03, F04, M05, and F06 were first captured in the landfill in May 2000; Bears M08 and F09 were first captured at Firth Lake in May 2000)

Bear re-captured in landfill

Bear re-captured in landfill: daytime-weekday ear-tag transmitter replaced by 24-hr transmitter (ear-tag or radio collar)

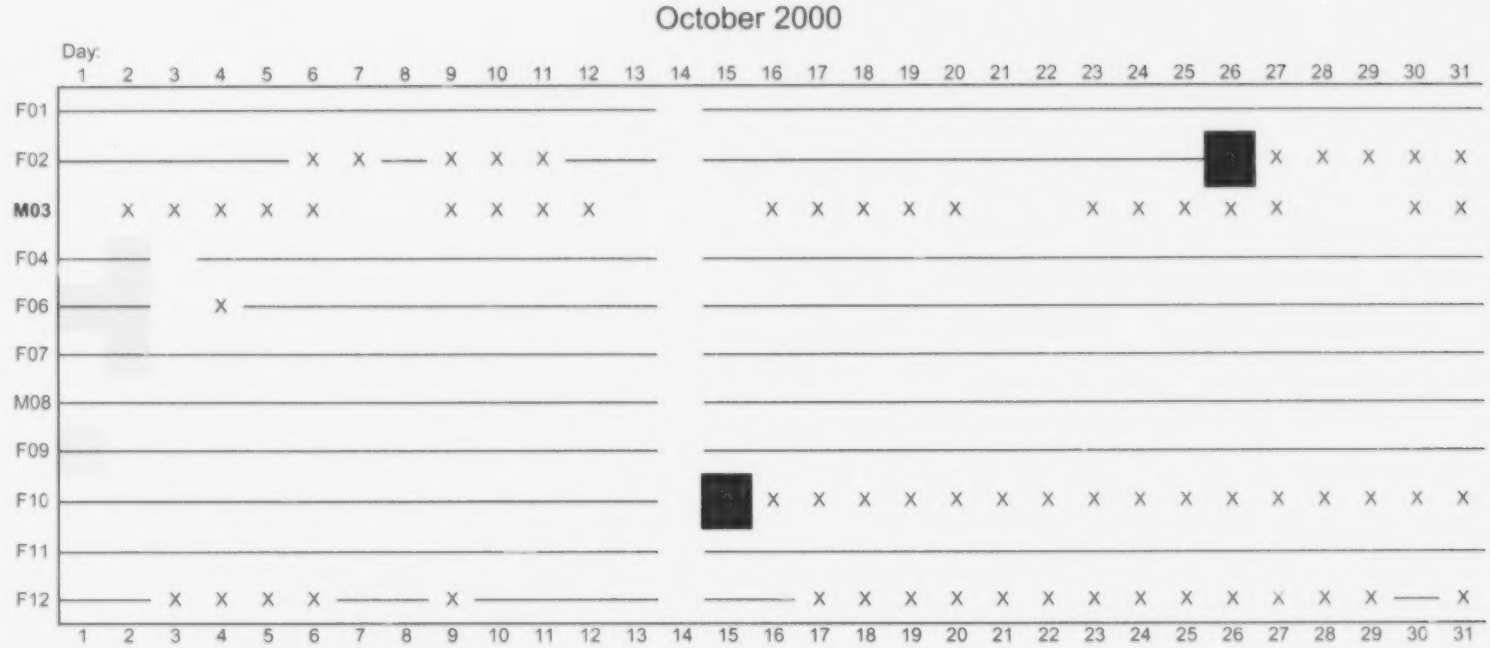
Bear visited landfill for last time in 2000

—— Bear used landfill (in vicinity of landfill during the day for bears wearing daytime-weekday transmitters, in landfill at night for all others)

X Bear did not use landfill

blank cell Not applicable: bear not radio-tagged, datalogger not working, ear-tag transmitter turned off, or transmitter dropped off

APPENDIX M. Use of McLeod Lake landfill by radio-tagged grizzly bears in October 2000



*Bears in **boldface** wore daytime-weekday ear-tag transmitters (until replaced); all other bears wore 24-hr transmitters (ear-tag or radio collar)

Bear first captured (Bears F01, F02, M03, F04, M05, and F06 were first captured in the landfill in May 2000; Bears M08 and F09 were first captured at Firth Lake in May 2000)

Bear re-captured in landfill

Bear re-captured in landfill: daytime-weekday ear-tag transmitter replaced by 24-hr transmitter (ear-tag or radio collar)

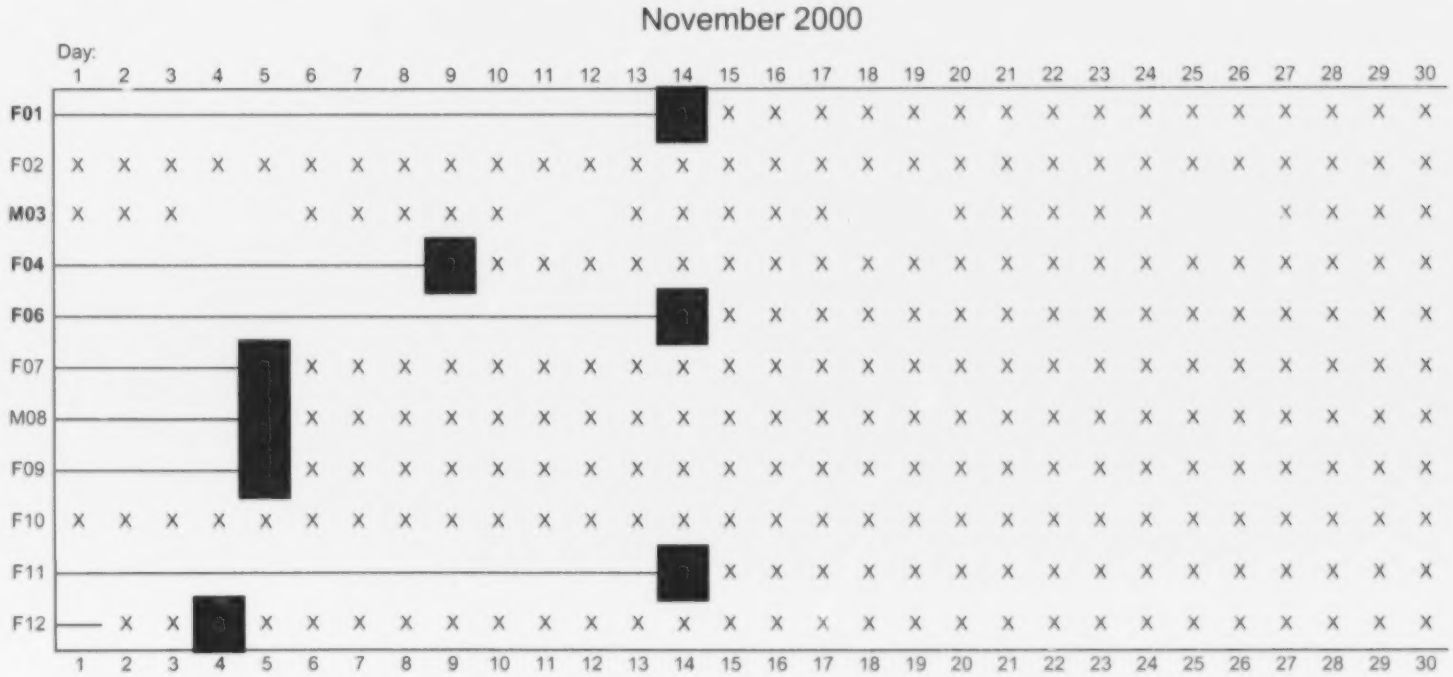
Bear visited landfill for last time in 2000

—— Bear used landfill (in vicinity of landfill during the day for bears wearing daytime-weekday transmitters, in landfill at night for all others)

X Bear did not use landfill

blank cell Not applicable: bear not radio-tagged, datalogger not working, ear-tag transmitter turned off, or transmitter dropped off

APPENDIX N. Use of McLeod Lake landfill by radio-tagged grizzly bears in November 2000



*Bears in **boldface** wore daytime-weekday ear-tag transmitters (until replaced); all other bears wore 24-hr transmitters (ear-tag or radio collar)

Bear first captured (Bears F01, F02, M03, F04, M05, and F06 were first captured in the landfill in May 2000; Bears M08 and F09 were first captured at Firth Lake in May 2000)

Bear re-captured in landfill

Bear re-captured in landfill: daytime-weekday ear-tag transmitter replaced by 24-hr transmitter (ear-tag or radio collar)

Bear visited landfill for last time in 2000

Bear used landfill (in vicinity of landfill during the day for bears wearing daytime-weekday transmitters, in landfill at night for all others)

X — Bear did not use landfill

blank cell — Not applicable: bear not radio-tagged, datalogger not working, ear-tag transmitter turned off, or transmitter dropped off